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VOL II - PART 2

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FULL-SCALE INCINERATION SYSTEM TRIAL BURNS AT THE NAVAL BATTALION CONSTRUCTION CENTER, GULFPORT, MISSISSIPPI - VOL II: PART 2

D. J. HALEY, R. W. THOMAS

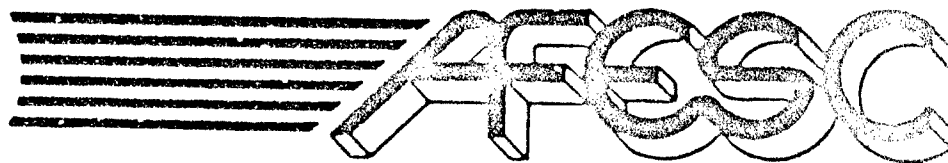EG&G IDAHO, INC.
P. O. BOX 1625
IDAHO FALLS ID 83415

JULY 1991

FINAL REPORT

SEPTEMBER 1986 - FEBRUARY 1989

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AIR FORCE ENGINEERING & SERVICES CENTER
ENGINEERING & SERVICES LABORATORY
TYNDALL AIR FORCE BASE, FLORIDA 32403

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17.	COSATI CODES		18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Herbicide Orange Dioxin Incineration

19 ABSTRACT (Continue on reverse if necessary and identify by block number)
This technical report is divided into eight volumes. This portion of the report comprises
Volume III, which is further divided into two parts, including the appendixes. This volume
describes the tests conducted on a 100 ton/day mobile incinerator that was used to process
soil contamination with the constituents of Herbicide Orange, namely 2,4,5-T, 2,4-D, and
trace quantities of dioxin. The purpose of the tests was to determine if the incinerator
could satisfy requirements of the Resource Conservation and Battalion Center in Gulfport,
Mississippi. This volume provides specific details concerning the planning efforts and
data results from the tests. Project managers and field engineers responsible for planning
and implementation of hazardous waste remedial actions should find the information in this
report to be very useful.

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PREFACE

This report was prepared by EG&G Idaho, Inc., P. O. Box 1625, Idaho Falls, ID 83415, under Job Order Number (JON) 2103 9027, for the Air Force Engineering and Services Center, Engineering and Services Laboratory, Tyndall Air Force Base, Florida 32403-6001.

This report summarizes work done between January 1987 and May 1987. Major Terry Stoddart and Major Michael L. Shelley were the AFESC/RDVS Project Officers.

The information contained in this volume describes the events, the planning efforts, and the data results of a trial burn conducted on a 100 ton/day mobile incinerator that was used to process soil contaminated with constituents of herbicide orange. This volume is subdivided into two parts; Part 1 contains the final report on the trial burns, and Appendix A. Part 2 contains Appendix B-H. Volumes I and II through IV through VIII describe the incinerator operations, the soil excavation activities, and the additional testing required by the Environmental Protection Agency.

This report has been reviewed by the Public Affairs Office (PA) and is releasable to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

MICHAEL L SHELLEY, Maj, USAF, BSC   FRANK P. GALLAGHER III, Col, USAF
Chief, Environmental Actions R&D   Director, Engineering and Services
                                            Laboratory

NEIL J. LAMB, Lt Col, USAF, BSC
Chief, Environics Division

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LIST OF APPENDIXES

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APPENDIX A

CORRESPONDENCE WITH EPA REGION IV ON DATA
PACKAGE FOR INCINERATOR VERIFICATION TEST BURNS AT NCBC

Appendix A contains the correspondence between EPA and the Air Force concerning the Verification Test burn data package. This appendix was reproduced from the best available copy.

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV.

345 COURTLAND STREET
ATLANTA, GEORGIA 30355

MAR 0 4 1987

4WD-RM

Mr. James R. Van Orman
Deputy Director
Engineering & Services Laboratory
Headquarters
AFE SC/RD
Tyndall AFB, FL 32403-6001

Dear Mr. Van Orman:

We have reviewed the data from ENSCO's trial burn in March 1986 provided in the "Application for Certification to Incinerate Hazardous Wastes F020 through F028" dated January 30, 1987 Analysis of Data from the March 1986, tests of the MWP-2000" dated December 19, 1986.. ENSCO clearly states that they did not meet the 99.9999% DRE standard for dioxin wastes on the POHCs (Principal Organic Hazardous Constituents) they had specified in their RCRA trial burn plan. We did note that ENSCO achieved seven and eight nines DRE on PCBs. Since they only analyzed for total PCBs and not for specific PCB isomers in the waste feeds and stack gas samples, the PCB data can not be used for dioxin certification under 40 CFR§265.352 (see the Federal Register of January 14, 1985/Vol. 50, No. 9/pages 1978-2006).

As discussed with you and your staff on a number of occassions during the last year, you can not incinerate the dioxin contaminated soils at the Naval Constructor. Battalion Center at Gulfport, MS until we have reviewed data which you or ENSCO has submitted from a RCRA trial burn conducted with POHCs more difficult to destroy than dioxings in a soil matrix.

Therefore the Air Force must provide a trial burn plan for our review for a trial burn to be conducted on the incinerator at Gulfport on ENSCO's same design mobile incinerator at EL Dorado. We would recommend that you consider using hexachlorobenzene mixed with clean soils at Gulfport for the trial burn or repeat the phase V RCRA trial burn at El Dorado.

If we can be of any assitance to you please give us a call.

Sincerely yours,

Patrick M. Tobin, Director
Waste Management Division

cc: Sam Mabry, MS DNR
    Art Linton, Federal Facilities Coordinator

Appendix A, Exhibit 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30355

MAR 2 7 1987

WD-RM

Mr. James R. Van Orman
Deputy Director
Engineering & Services Laboratory
Headquarters
AFE SC/RD
Tyndall AFB, Florida 32403-6001

Dear Mr. Van Orman:

We have reviewed the <u>Trial Burn Plan Dioxin Surrogates for the ENSCO MWP 2000 at the Naval Construction Battalion Center, Gulfport, Mississippi</u> dated 20 March 1987 and have determined that it is not approvable as written. Enclosed is a list of deficiencies and items that need clarification.

The major items which must addressed before the trial burn are:

° Detailed description of the waste feed system and how it will accurately measure the quantity and feed rate of the solid waste feed.

° Detailed description of the analytical and sample preparation techniques that will be used for each type of sample taken.

° Samples must be composited over each <u>run</u> rather than each test.

° Detailed description of the QA/QC procedures, and how the data will be used.

The plan submitted was too generic.

Some of the enclosed comments have been discussed by telephone with Dan Haley of EG & G and Darrell Derrington of Versar. If you need any further clarifications, please contact Betty C. Willis of my staff at (404) 347-3433. We will continue to work closely with your staff in the finalization of this trial burn plan. Your staff and contractors did an admirable job given the limited amount of time they had to work on

this document. Even though the enclosed list looks long, we feel that
the items that must be addressed before approval of the testing can be
very quickly and easily resolved by your staff and contractors

Sincerely yours,

George L. Herlou

Patrick M. Tobin, Director
Waste Management Division

Enclosure

cc: Dan Haley, EG & G, Idaho
    Darrell Derrington, Versar
    Barry Rieter, ENSCO
    Sam Mabry, MS, DNR

Clarifications Needed and
Deficiencies in the Trial Burn Plan
for ENSCO MWP2000 at NCBC
Gulfport, Mississippi

*1.   The trial burn plan (TBP) must be signed and certified as required
       by 40 CFR §270.11 and permit Condition I-G.

2.   The revised TBP should have the pages numbered for ease of reference.
       The page numbers referenced hereafter were arrived at by sequentially
       numbering each page in each section, i.e., page II-3 is page 3 in
       section II.

3.   The last sentence on page I-2 should have "and RCRA" deleted since
       ENSCO did not demonstrate greater than 6-9s DRE in the Eldorado RCRA
       burns.

4.   Page I-5, in paragraphs 1 and 2, says that an objective of this trial
       burn is to "obtain a RCRA non-liquid permit for operation." Does the
       Air Force intend to seek an operating permit rather than complete the
       NCBC work under the RD&D permit?

5.   Your current RD&D permit does not allow the burning of contaminated
       water (see Condition III-D). On page I-8, paragraph f implies that
       you may burn contaminated water in the incinerator. This will require
       a permit modification, but we agree that if the water is fed only in
       the kiln and the kiln and SCC temperatures are maintained that the
       water should not significantly effect the combustion process, therefore
       we are not going to require a change in the TBP to include a water
       waste stream.

6.   On page II-6 it appears that the "access lid" is what is more commonly
       referred to as a "dump stack" or "thermal relief valve (TRV)." A
       complete description needs to be provided of the specific conditions
       that cause this lid to open and what functions of the incineration
       system stay on and what shuts down. Is it opened automatically (if
       so what readings on what instruments trigger this) or manually by the
       operator (if so what criteria will he use to determine when to open it)?
       What backup systems does ENSCO have to reduce the frequency of this
       event? Please provide calculations showing that the dump stack height
       is sufficient to create a negative draft at the face plate of the
       kiln and/or data taken while the TRV is open that shows a negative
       pressure is maintained. The Contingency Plan should address what
       actions will be taken if the TRV does open while hazardous wastes are
       present in the incinerator.

*7.   On several pages in Section II (II-10, 12, 17, 18, 19, etc.) the TBP
       just says "a device" is used to measure the vacuum or another parameter.
       Please specify what device is being used for these purposes.

8. On page II-17 it says the stack height is 35.5 feet high and yet when you add all the components up it would appear to be 46.5 feet high yet Drawing 8 shows the stack as 40 feet from ground level. Please revise the document to correctly describe the stack height in all places.

9. On page II-22 it says that the solid which settles out in the Effluent Unit "are handled identically to the kiln ash." How are these solids dewatered (all free liquids removed) before they are "landfilled?"

10. On page II-23, and/or elsewhere in the document you need to more clearly describe how you will arrive at the solid waste feed rates. Describe the weigh hopper, its capacity by volume and weight, type of weighing device, accuracy of measurements, units of measure, is it connected to the computer, if so does the computer calculate feed rates or only record weights, and are the weights accurate enough to demonstrate 6-9's DRE?

*11. A more complete description needs to be provided on page II-24 of the feed hopper and screw auger so we can determine how far in advance of the trial burn you should begin taking solid waste samples.

12. Under Section II-G you must include an Automatic Waste Feed Shut Off (AWFSO) tied to an indicator of combustion gas velocity that indicates the gaseous residence time in the Secondary Combustion Chamber (SCC) is < 1 second as required by Condition III.E.9.d of your permit. Even though your RD&D permit does not require an AWFSO system for exceeding the maximum waste feed rate and minimum water flow rates to the packed tower and the scrubber during the trial burn or opening of the TRV, you should include these AWFSOs since these shut offs would normally be required on a RCRA incinerator and the purpose of the RD&D permit is to collect data on the reliabililty, maintainability, and cost-effectiveness of using a RCRA incinerator at military bases. For any changes made submit verbal descriptions and modified blue prints.

*13. On pages II-31, 32 and/or elsewhere in the TBP you need to provide complete descriptions of the O_2, CO, and CO_2 monitors; what is the range of each one, what concentration of calibration gases are used, are they NBS traceable, are the calibration gases fed through the complete sampling line and conditioning systems etc.?

14. EPA does not agree that having a technician present in the control room where numerous indicator devices are installed constitutes "continuous monitoring." Continuous monitoring can only be achieved by strip chart recorders (or other pen and ink type recorders) or computer storage of the data where each data point is no more than 1-2 seconds apart. Please revise your definition on page II-33 and all the tables and charts in the TBP where "Continuous" is used incorrectly. If the technician manually logs certain data on a set frequency to assure that he is monitoring the various indicator devices, then that time frequency should be entered in the charts.

15. If any device that triggers (or should trigger) an AWFSO malfunctions then you must stop solid waste feed until it can be repaired, unless you have a backup device which you can use. We agree that for all other meters or measuring devices you can continue waste feed for 15 minutes while repairing it. Please revise the tables in Sections II and III accordingly.

*16. On page II-39 it indicates under "Location," NA for the secondary combustion gas residence time. The TBP needs to describe how the computer will calculate the residence time – what data from what device(s) will be used. The location of those devices should be used on page II-39 instead of NA.

17. On page II-40 you need to include what you are using to assure a negative pressure at the face of the kiln and the outlet gas temperature from the SCC.

18. From Drawing 6 it appears that the thermocouple that is connected to the AWFSO system is monitoring the refractory rather than the combustion gases, if this is not true, please explain the significance of some TEs going to the surface of the secondary combustion chamber (SCC) and other TEs extending inside the SCC. Are there actually two thermocouples connected to TE 222 or is TE 223 the redundant thermocouple mentioned on page II-30? If TE 223 is the redundant thermocouple it must also be connected to the ASFSO system.

*19. Even though your method of mixing the sand and POHC seems to be as good as can be done, we recognize that it is extremely difficult to mix three solids homogeneously and therefore there is a very distinct possibility that even though you take three grab samples every 15 minutes those samples may not, when analyzed, give POHC concentrations in the 1500 - 3000ppm range. We therefore request that you also very accurately weigh the amount of each POHC added to each batch used in each run and calculate the theoretical concentration of each POHC burned during each run and compare that to the analytically determined concentration in the composited waste feed samples. If good correlation is not achieved, then you must use the more con-servative amount of POHC as the "POHC in mass" in calculating the DRE. Section III also needs to discuss when contaminated sand feed will begin in relation to the beginning of stack gas sampling. If the solids residence time is 30 minutes then the contaminated sand must be fed for 30 minutes before beginning stack sampling. Please change Section III appropriately.

*20. We recommend that you take a blank water sample from the neutralization tank before this trial burn begins rather than from the water tap. On page III-7 and elsewhere in the TBP you need to change your sampling matrix to include sampling of the water effluent prior to the carbon absorption unit to use in estimating the fate of the POHCs (§270.62(b)(6)(iii).

*21. All through Section III it refers to compositing samples of feedstock, solid residue and water after the test is completed. You must composite these samples for each run so you will have three separate samples for each test.

*22.   On page III-9 you may want to be more specific on what you mean by "clean aluminum foil" and with what you are going to cover the stainles steel bucket. If the foil and what ever you cover the bucket with is not cleaned with solvents prior to use, you may pick up contamination from them. Since any contamination picked up would tend to give higher numbers we are not requiring you to make any changes in this regard, but we want to make sure you are aware of the potential problem.

*23.   Section 2.1 needs to specify whether or not the grab samples of feedstock will be capped until after the run when they are all composited.

*24.   On page III-10 and elsewhere in the TBP you may want to change your procedures to include XAD traps in both Method 5 trains. The extra XAD traps in the particulate train could be archived in case you "loose" any XAD traps from the POHC train.

*25.   On page III-10 and elsewhere you need to specify what concentration of what alkaline chemical will be used in the second impinger for chlorides determination.

*26.   Page III-26 (first page after Table III.D-1) needs to be revised to agree with page III-12 and the EPA Method 5 procedures which requires all the front half of the train to be rinsed and the weight of the particulate in the rinsate to be added to the weight of the particulate on the filter.

*27.   Table III.D.2 needs to be revised to include the samples from both MM5 trains and the blanks of methylene chloride and methanol discussed on the previous page. Do you intend to save any blanks on the POHCs? Tables III.D.2 and III.E.3.1 must be consistent with each other.

*28.   On page III-30 you need to specify what preservatives will be used in which samples, how long each type of sample will be stored prior to analysis, and how the samples will be stored, or reference future page numbers where the TBP discusses storing the samples in ice chests etc.

*29.   On pages III-33, 34, and several other places in the TBP it says you will use a "solvent of choice" or "sorbent of choice." All these references must be changed to specify exactly what will be used. If a different solvent(s) will be used on the two different MM5 trains then you need to specify that also. You also need to go through each of the EPA test methods included in Appendix I and where these generic methods say to select an appropriate chemical or extraction medium or clean-up technique, etc., you need to specify what chemicals technique etc., you will use for HCE and HCB. We recommend that you make sure IT or whatever analytical labs you use, have looked over this portion of the TBP and are prepared to do the methods exactly as they are specified in the revised document.

*30.   Pages III-33 to 36 need to be revised to specify that two MM5
         trains will be used and how the particulate filters, probe rinses,
         etc., from each train will be handled. Both trains are necessary and
         technically possible.

31.   On pages III-40 and 41 what does "" mean? You also need to include
         stack gas CO. The soil residence time and the gas residence time
         should be held constant during each _test_. The TBP must specify
         how you are calculating the residence time.

32.   Section III.H also needs to be revised to include the AWFSOs dis-
         cussed in our earlier comment.

33.   Section III.I needs to include inspection frequency for cleaning
         the flame detector lens (missing in both places) and inspecting the
         oil level in the compressor. From this section it appears that you
         have CO and O2 meters in the SCC as well as the stack, is this correct?
         The O2 and CO monitors should be calibrated (four points on scale)
         weekly instead of monthly. This table should also include weekly
         testing of the AWFSO Systems.

34.   Page 1 of the SPCC Plan says the incinerator is a 4 ton/hr kiln,
         this needs to be changed to be consistent with the rest of the TBP.

35.   In Section 3.5 of the SPCC please fill in the blanks on the
         distance between the acids and caustics storage areas.

36.   Appendix I seems to be missing a number of Sections, i.e., it
         jumps from 14.0A to 3.0B. Please clarify if there should be
         Sections 1B and 2B.

37.   In Appendix I, Section 3.1A and elsewhere in the TBP (Section II)
         it appears that there is a misunderstanding of what EPA is
         requiring for compliance with the regulatory requirement to
         continuously monitor the "indicator of combustion gas velocity"
         in 40 CFR §264.346. An annubar is an acceptable method if it is
         located such that it is actually measuring the velocity of the
         gases exiting the combustion chamber, but from the blue prints it
         appears that the annubars are in the lines from the combustion air
         blowers. Since this incinerator is under negative pressure what
         is the correlation between flow rate of the combustion air and the
         velocity of the gases exiting each combustion chamber? Provide
         documentation to support the correlation.

*38.   Table 3.1 should include the QA objectives for the waste feed rate.

*39.   Section 6.1.2A states that the calibration criteria for the gas
         monitors, thermocouples and weigh hopper are specified in Section
         II. I could not find the criteria; it must be included in the TBP
         so either include it or discuss exactly where it is located.

Page 5 of 6

*40. Section 7.0A states that "no analyses are required for ...samples that will be collected." Please clarify this statement.

*41. The formula you have proposed in Section 8.1A for calculating HCl removal efficiency does not make sense, because you can't subtract volume rates from mass rates. Please explain what "HRE" stands for, what "HCl produced" is and what "Volume rate of gas" is or replace this formula with the standard formulas for calculating the HCl emmissions (see attachment). Rewrite this section to clearly explain how you plan to determine the HCl concentration in the gases prior to entering the pollution control equipment if you intend to demonstrate 99% removal rather than compliance with the 4 pounds per hour limit.

*42. Section 8.3A must specify the frequency at which the micro processor will record the operating parameters; "on a periodic basis" is not adequate.

*43. Section 3.0B, 3.1.3 references Table 2, where is it located?

*44. Please explain what is meant by "Corrected Concentration data" in Section 3.5. The information developed under the QA/QC Plan cannot be used to correct raw data. You must report all data from all analyses. You can use QA/QC data to explain whether or not you think a particular number is correct, but you cannot use it to "correct" that number.

*45. Table III. B.1 needs to be totally redone. What is matrix code 6, what specific methods in SW-846 will be used, what does 24.9 standard deviation mean and what does an accuracy of D-152 mean? Please explain why you expect an accuracy range of 4-113% on HCE, i.e., +13% and - 96% is pretty unusual.

46. For completeness it would be a good idea to include Method 325.3.

*47. Section 9.0B and elsewhere in the TBP must be revised to include what chemicals will be used for calibration standards, and spiked surrogate compounds.

48. Section 10.0B says there will be two analytical labs involved with this project. The TBP previously had only mentioned IT in Knoxville, please clarify.

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EGG-HWP-7672

TRIAL BURN PLAN
DIOXIN SURROGATES FOR THE ENSCO MWP 2000 AT
THE NAVAL CONSTRUCTION BATTALION CENTER

GULFPORT, MISSISSIPPI

PREPARED BY

IDAHO NATIONAL ENGINEERING LABORATORY
EG&G IDAHO INC.

ENVIRONMENTAL SYSTEMS
COMPANY INC.

VERSAR INC.

AND

THE AIR FORCE ENGINEERING AND SERVICES CENTER

April 17, 1987

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INEL

Idaho National Engineering Laboratory

April 17, 1987

Maj. T. L. Stoddart
HQ AFESC/RDVW
Building 1117
Tyndall AFB, FL 32403

TRANSMITTAL OF FINAL NCBC TRIAL BURN PLAN - DJH-05-87

Dear Maj. Stoddart:

Enclosed is the final NCBC Trial Burn Plan for the USAF Full-Scale
Demonstration Project in Gulfport, MS. Four (4) copies of this document
are being provided to Ms. Betty Willis of EPA Region IV.

A disposition summary of specific comments from the original submission is
incorporated as Appendix II of the Trial Burn Plan.

This document has been submitted to INEL Safety and Quality organizations
for review, and will be complete before the scheduled trial burn begins.

If you have questions regarding this document, please contact me in Idaho
at (208)-526-9959 through April 23, and at the Gulfport field office
(601-864-4139) after that date.

Very truly yours,

Daniel J. Haley
Sr. Program Specialist
Hazardous Waste Projects

Enclosures:
As Stated

cc: I. Aoki, DOE-ID (w/o Encl.)
     ~~U. A. ~~
     B. A. Reiter, Ensco, Inc.
     J. O. Zane, EG&G Idaho (w/o Encl.)

EG&G Idaho Inc   P.O. Box 1625   Idaho Falls, ID 83415

CONTENTS

ACRONYMS

ASTM	American Society of Testing Materials
AWFSO	Automatic Waste Feed Shut Off
BDL	Below Detection Limit
BTU	British Thermal Unit
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DAS	Data Acquisition System
DCPAA	2,4-Dichlorophenoxyacetic Acid (2,4-D)
DRE	Destruction and Removal Efficiency
ECEM	Extractive Continuous Emission Monitor
ENSCO	Environmental Systems Company
ENT	Effluent Neutralization Tank
EPA	Environmental Protection Agency
FRP	Fiberglass Reinforced Plastic
GC	Gas Chromotography
GC/MS	Gas Chromotography/Mass Spectrometry
HCl	Hydrogen Chloride
HCE	Hexachloroethane
HCL	Hydrogen Chloride
HO	Herbicide Orange
K PEG	K Polyethylene Glycol
MAD	Maintenance Assembly-Disassembly
MCC	Motor Control Center
MS	Mass Spectrometry
MWP	Mobil Waste Processor
NCBC	Naval Construction Battalion Center
NDIR	Non-Dispersive Infrared
P&ID	Piping and Instrument Diagram
POHC	Principal Organic Hazardous Constituents
POTW	Publically Owned Treatment Works
QA	Quality Control
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QCC	Quality Control Coordinator

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RCRA	Resource Conservation and Recovery Act
RD&D	Research Develpoment and Demonstration
RD&D	Research Development and Demonstration
RSD	Relative Standard Deviation
SCC	Secondary Combustion Chamber
SD	Standard Deviation
SPCC	Spill Prevention Control and Countermeasures
TCB	Trichlorobenzene
TCDD	Tetrachlorodibenzodioxin
TCPAA	Trichlorophenoxyacetic Acid (2,4,5-T)
USAF	United States Air Force
WC	Warm Column, in.
XAD	XAD-2 Sorbent Resin

SECTION I
PROJECT DESCRIPTION

I.A. Introduction

The purpose of this trial burn is to obtain data, which when combined with data already available, will verify that dioxins and other hazardous organic substances are adequately destroyed by incineration in the ENSCO MWP-2000 and that the resulting stack emissions will pose no unacceptable risk to the health and safety of the surrounding communities. The trial burn is primarily designed to provide data to support the issuance of Federal permits under the auspices of the Resource Conservation and Recovery Act to facilitate operation of the MWP-2000 at the Naval Construction Battalion Center, Gulfport Mississippi. The tests described by this plan are intended to provide sufficient data to allow the use of the incinerator for destruction of polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans, and most RCRA-listed substances.

The Naval Construction Battalion Center, Gulfport, Mississippi was a former storage/trans-shipment point for Herbicide Orange used in South East Asia. The Herbicide Orange stored at NCBC was contaminated with 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) at average concentrations of 2.0 mg/L. Spillage of the herbicide during handling resulted in approximately 11,000 cubic yards of soil contaminated with TCDD at concentrations up to 600 parts per billion (ug/kg). The trial burn plan discussed here is part of the Air Force's research and development program targeted at demonstrating technologies capable of removing the TCDD contamination from soils and returning the contaminated sites to beneficial use.

A previous verification trial burn was conducted at NCBC during December, 1986. This test was accomplished to support a full scale field trial of the system at NCBC as permitted under the U.S. EPA, Region 4 RCRA RD&D permit number MS2 170 022 626. Results of the December 1986 test

indicated that the unit was capable of reducing the concentrations of TCDD in native contaminated soil to levels at or below 1.0 parts per trillion (ng/kg). Although no TCDD was detected in the stack gas samples collected during the five verification tests, Destruction and Removal Efficiencies (DRE) could not be demonstrated at 6x9s or greater due to the low concentrations of TCDD in the soil feed stock. During the verification tests at NCBC, two of the five test runs demonstrated a 6x9s DRE for the herbicide 2,4,5-T which was present as a POHC in the soil feed stock. The tests demonstrating the 99.9999% DRE were performed at 3.7 ton/h and 6.3 ton/h feed rates. 2,4,5-T is ranked as more difficult to destroy than TCDD based on the heat of combustion ranking system.

Official trial burns have been conducted with a similar unit located at El Dorado, Arkansas under the authority of the Toxic Substances Control Act and The Resource Conservation And Recovery Act. The El Dorado tests demonstrated 6x9s DRE for Polychlorinatedbiphenyl (TSCA) and 4x9s DRE for a variety of RCRA substances. Currently, the MWP-2000 is authorized to thermally treat all RCRA substances with a heat of combustion greater than carbon tetrachloride with the exception of the FO 20 through FO 23 series of waste that requires a 6x9s DRE as compared to the 4x9s DRE required of all other RCRA listed chemicals. EPA Headquarters has notified ENSCO and Region 4 that the MWP-2000 has successfully completed a TOSCA trial burn and will issue a national permit stating that the system is certified at 6x9s DRE for polychlorinatedbiphenyl.

Additional performance data needed at this time relate to the destruction of TCDD on solids. Current RCRA regulations call for the demonstration of a destruction and removal efficiency of 99.9999% or greater for dioxin wastes (FO 20 - FO 27). The DRE is computed from the emission rate of hazardous substances in the incinerator stack and the feed rate of the material to the incinerator.

The current state of the art for incinerator operations is such that very low levels of contaminants emitted from the incinerator stack can not be measured on a continuous basis; such measurements require specialized stack sampling equipment and extremely sensitive laboratory instruments

such as high resolution gas chromatography/high resolution mass spectrometry. Conversely, parameters for monitoring and controlling incinerator operations such as temperature, oxygen, carbon dioxide, and carbon monoxide can be measured continuously with conventional equipment. One purpose of this trial burn is to establish a correlation between the routinely monitored combustion parameters and the emission rate for the contaminants being processed. Since stack gas sampling can not be accomplished routinely the established correlation between the combustion parameters and the stack emissions can be used to set the performance envelope for controlling the incinerator during routine operations. Assuming a successful trial burn, those operational conditions employed would then be established as the operational set points for continued treatment of contaminated soil.

The Air Force-sponsored full scale field trial of the MWP-2000 incinerator will be conducted after the trial burn if the DRE performance is judged to be adequate. The purpose of the full scale field trial will be to collect engineering and scientific data to determine the reliability, maintainability, and cost-effectiveness of the MWP 2000 for possible application at other military sites and, if possible, return the site to beneficial use. These data will also be helpful in supporting the concept that transportable thermal treatment systems offer an alternative for ultimate disposal of hazardous waste as stipulated by the 7 Nov 86 Land Disposal Ban.

I.B. Trial Burn Scope

The trial burn program consists of two tests, each with three replicate performances. The two tests will be conducted with different feed rates.

I.B.1. Test 7

During test 7, sand containing Hexachloroethane (HCE) and Trichlorobenzene (TCB) will be fed into the rotary kiln at a nominal rate of 4 tons per hour. Three replicate runs will be performed at this feed

rate. The objectives of this test will be to demonstrate greater than 99.9999% DRE for the dioxin surrogates and obtain permission from Region 4 to operate at the designated feed rate to treat dioxin-contaminated soils at NCBC.

I.B.2. Test 8

During this test, sand containing HCE and TCB will be fed to the rotary kiln at a rate of 5 tons per hour. Three replicate runs will be performed at this feed rate. The objectives of this test will be to demonstrate greater than 99.9999% DRE for the dioxin surrogates and obtain permission from Region 4 to operate at the designated feed rate to treat dioxin-contaminated soils at NCBC.

I.B.3. The Trial Burn Summary

The trial burn protocol is discussed in Section III.G. The Quality Assurance Project Plan for this trial burn is presented in Appendix I.

I.C. Proposed Trial Burn Date

The trial burn for the MWP 2000 is planned to start in April 1987. The exact date is dependent on review and approval of this trial burn plan by EPA Region 4. A tentative schedule is presented in Table I.C.1.

I.D. Trial Burn Permit Objectives

If the RCRA DRE, particulate, and HCL performance standards (40 CFR 264) are achieved during the trial burn, the RCRA incineration operating permit (RD&D) should allow the MWP-2000 to be used to incinerate RCRA hazardous solids at the rates established by the test burn operating conditions.

·TABLE I.C.1. TENTATIVE TRIAL BURN SCHEDULE

ACTIVITY	TIME (DAYS)[a]
Notification of test plan approval	0
Mobilization	6
Blend surrogate	TBD
Fire incinerator	11
Clean soil test	TBD
Start Test 7, run A	15
Start Test 7, run B	16
Start Test 7, run C	18
Submit test 7 samples to lab	19
Start Test 8, run A	21
Start Test 8, run B	22
Start Test 8, run C	24
Submit test 2 samples to lab	25
Shut down incinerator	25
Hold for lab results	38
Submit trial burn report to EPA	45
Receive EPA approval	59
Begin routine operations	60

a. Cumulative time in days beginning on day of test plan approval.

I.D.1. Anticipated RCRA Permit conditions for solid wastes covered under
the existing Air Force RD&D permit issued by Region 4.

I.D.1.a. Appendix VIII Constituents. The solids test burn includes
two POHCs with heats of combustions of 0.46 and 3.40 kcal/gm. Since all
dioxin and furan isomers have a higher heat of combustion value than the
surrogate POHCs, there should be no permit limitations on the types of
furan and dioxin isomers that can be incinerated. Additionally, any
Appendix VIII constituent with a higher heat of combustion than the trial
burn POHCs would also be able to be incinerated (in a solid matrix).

I.D.1.b. Minimum BTU/lb. There will be no permit requirement that
specifies a maximum or minimum solids heat value.

I.D.1.c. HCL Emissions. Emissions of HCL will be controlled, such
that the rate of emissions is no greater than the larger of either 1,8 kg/h
or 1.0% of the HCL in the stack gas prior to entering any pollution control
equipment.

I.D.1.d. Particulate Matter. The incinerator will not emit
particulate matter in excess of 180 mg/dscm when corrected for the amount
of oxygen in the stack gas in accordance with the formula specified in
40 CFR 264.343 (c).

I.D.1.e. Combustion Efficiency. Combustion efficiency, as measured
by $CO2/(CO2 + CO) \times 100$, will be maintained at greater than 99%. CO2 and
CO will be measured in the stack gases.

I.D.1.f. Water Feed Rate. There will be no special permit conditions
on the feeding of contaminated or noncontaminated water. Water can be used
as a means of kiln combustor temperature control and does not significantly
effect the combustion process. The limiting rate of water feed will be
controlled by maintaining the the kiln and SCC temperature as specified by
permitted operating conditions.

I.D.1.g.   Incinerator Operating Permit Conditions.

I.D.1.g.(1)--The rotary kiln temperature, as measured by the outlet gas thermocouple, will be maintained at greater than 1350° F.

I.D.1.g.(2)--The secondary combustion chamber temperature, as measured by the outlet gas thermocouple, will be maintained at 2150° F.

I.D.1.g.(3)--The residence time, as calculated from mass flow rate and and gas temperature, shall be maintained at greater than 1.0 seconds.

I.D.1.g.(4)--The recirculation flow rate to the packed tower shall be maintained to meet the scrubber efficiency requirements.

I.D.1.g.(5)--The recirculation flow rates to the scrubber shall be maintained to meet scrubber efficiency requirements.

I.D.1.g.(6)--Fugitive emissions from the combustion zone will be controlled by operating the incinerator under negative pressure.

I.D.1.g.(7)--Combustion efficiency will be maintained at greater than 99% as measured by the formula $CO_2/(CO_2 + CO) \times 100$.

I.D.1.g.(8)--Oxygen concentrations in the stack gas will be maintained at greater than 3.0%.

I.D.1.g.(9)--No contaminated waste will be fed to the incinerator unless the incinerator is operating under conditions specified in this section.

I.E.   Maximum Waste To Be Treated

The permittee may treat up to 11,000 cubic yards of contaminated soil and debris as specified by section I.F of this document.

I.F. Limitations On Wastes

The permittee shall treat the following hazardous wastes with incineration:

Waste Code Number	Feed Rate	Description
FO 27	0-5 tons/h	Soil contaminated with Herbicide Orange and Misc. combustible and noncombustible materials including residual materials resulting from the K PEG chemical neutralization tests.

I.G. Cross Index

> NOTE: The purpose of this index is to cross-reference the contents of this trial burn plan to the EPA approved outline covering the preparation of trial burn plans.

SUBJECT REQUIREMENT	SECTION THIS DOCUMENT
99.9999% DRE	I, App. I
HCL Emissions	I, App. I
Particulate Emissions	I, III.D.2
DETAILED ENGINEERING DESCRIPTION	II
o. Mfg name/model number	II.A
o. Type incinerator	II.B
o. Incinerator description	II.C
o. Prime mover	II.F
o. Auto waste cutoff	II.G
o. Stack gas monitoring	II.H

SUBJECT REQUIREMENT	SECTION THIS DOCUMENT

o. Pollution control equipment .... II.H

o. Burner/nozzle design .... II.I

o. Construction materials .... II.J

o. Location/Description flow, pres. temp
measuring devices .... II.K

SAMPLING/MONITORING PROCEDURES

o. Sampling/Monitoring equipment .... III.D, III.F

o. Sampling/Monitoring frequency .... III.D, III.F

o. Analytical procedures .... III.E

o. Sampling/Monitoring locations .... III.D app I

o. QA/QC Program .... III.D app I

TEST SCHEDULE

o. Trial Burn date I

o. Duration of each test burn .... I, III.G

o. Quantity of waste for each test .... III.G

TEST PROTOCOLS

o. Ranges of temperature .... I, III.G

o. Waste feed rate .... I, III.G

o. Combustion gas velocity .... III.G

o. Other factors affecting DRE .... I, III.A

POLLUTION CONTROL DEVICES

o. Packed tower .... II.H

o. Scrubber/Demister .... II.H

SUBJECT REQUIREMENT	SECTION THIS DOCUMENT
SHUT DOWN PROCEDURES	
o. Rapid stopping waste feed	III.G
o. Incinerator shut down	III.H
o. Controlling emissions	I, II.H
PRINCIPAL ORGANIC HAZARDOUS CONSTITUENTS	
o. POHC #1	I, III.A
o. POHC #2	I, III.A

II. DESCRIPTION OF THE ENSCO MWP-2000

This section contains the detailed description and engineering drawings of the ENSCO MWP-2000 Modular Waste Processor (MWP-2000).

II.A Manufacturer's Name and Model Number

The unit to be tested in Gulfport, Mississippi is the MWP-2000 and is the third unit designed and built by ENSCO at the White Bluff, Tennessee manufacturing facility. Technical and engineering support is provided from the Franklin, Tennessee and Little Rock, Arkansas offices.

II.B Type of Incinerator

The MWP-2000 is a modular incineration system designed to destroy and detoxify solid, semi-solid, and/or liquid wastes. Most of the components of the system are installed on trailers, platforms or skids to facilitate the movement of the system from location to location to perform on-site clean-up of contaminated sites.

NOTE: Reduced versions of all drawings referenced in this section are included at the end of this section.

Drawing 1 shows the general arrangement of the system as it is installed at the Gulfport, Mississippi site. Figure II-1 shows a schematic diagram of the system. Both this Figure and Drawing 1 show the principal components of the system are:

o   Rotary Kiln, waste feed system, and outlet cyclones.

o   Secondary Combustor and auxiliary fuel system.

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o   Air Pollution Control Train consisting of

     -    Effluent Neutralization System
     -    Packed Tower
     -    Ejector Scrubber, Demister, and Stack.

The auxiliary components of the system are:

o   Waste Heat Boiler and Steam Drum.

o   Boiler water treatment unit.

o   Ash removal unit.

o   Effluent settling unit.

o   Effluent holding tanks.

II.C Incinerator Details: Principal Components

II.C.1 Rotary Kiln and Cyclones

    The rotary kiln is designed to be used primarily to burn solid wastes,
including PCB-contaminated materials introduced into the kiln by a screw
feed. Waste water and other materials can be introduced through designated
injection nozzles and burned in the kiln, however, this option is not
expected to be utilized at the NCBC site. Drawing 2 provides plan and
section views of the kiln and solid waste feed system. Drawing 3 provides
plan and section views of the two cyclones installed in the ductwork
between the kiln and the secondary combustor. Drawing 4 provides the P&ID
for the kiln.

    The kiln burner is designed to develop a thermal loading of
approximately 14 million BTU/hour and outlet gas temperatures of 1350 to
1800°F. Typically, the kiln will be operated at a stoichiometry of 1.1
to 1.5. The solids residence time will vary with the rate and type of

wastes being fed and can be varied by changing rotation speed of the kiln. The usual solids retention time in the kiln is 30 to 60 minutes.

Construction Materials and Dimensions:

The rotary kiln is a carbon steel cylinder mounted horizontally on a custom trailer and is lined with 5 inches of fire brick. The resulting interior dimensions are:

Kiln ID	-	5.5 feet
Kiln Length	-	30.0 feet
Effective Volume	-	697 ft^3

The kiln is mounted so that it is inclined 2 degrees, and is rotated by a hydraulically powered gear trunnion mechanism that can rotate the kiln from 0.5 to 4.0 revolutions per minute. The burner and the solids and liquid waste feed systems are located at the higher end of the kiln while the gas outlet and ash drop are located at the opposite lower end.

A pair of cyclones are installed, in parallel, in the ductwork between the kiln and the secondary combustor to remove lighter particulate that does not fall out in the kiln ash removal system. These solids would otherwise carry over into the secondary combustor when soil or other fine-grained inorganic solids are being burned in the kiln. The cyclones are lined with 4 inches of castable refractory.

Outlet gases from the kiln pass through the cyclones in a double vortex flow pattern and then into the outlet ductwork for conveyance to the secondary combustor. Particulate removed from the gases by the double vortex flow pattern falls to the bottom of the cyclones and flows by gravity into the ash receiving tank of the ash removal unit. The water contained within the ash removal unit quenches the hot particulate solids and serves as a liquid seal between the kiln, cyclone ductwork, and the transition ductwork to the secondary combustor.

II.C.2. Secondary Combustor

The secondary combustor is designed to further burn the gases discharged from the rotary kiln. (NOTE: In other areas of this document, the secondary combustor is also called the Secondary Combustion Chamber or SCC.) While the secondary combustor is capable of burning waste liquids injected through an injection nozzle, this option will not be utilized at the NCBC site except to process kerosene from the final equipment decontamination at the end of the project. Drawing 5 provides plan and section views of this unit. Drawing 6 provides the P&Iₒ for this unit.

The secondary combustor burner is designed to develop a thermal loading of approximately 24 million BTU/hour with an upper range outlet gas temperature of 2100 to 2400° F. Typically it will be operated at a stoichiometry of 1.2 to 1.5.

Construction Materials and Dimensions:

The secondary combustor is a carbon steel cylinder mounted horizontally on two supports on a custom trailer. It is lined with 2.25 inches of insulating brick and 4.50 inches of fire brick. The resulting interior dimensions are:

Secondary ID	-	79.5 inches
Secondary Length	-	40.0 feet
Effective Volume	-	1377 ft^3

Gases from the cyclone are delivered to the secondary combustor through a rectangular carbon steel duct lined with 4 inches of castable refractory. The duct introduces gases into the secondary combustor tangentially through a 1.75 ft x 3.50 ft rectangular port on the upper right side of the inlet end of the secondary.

Gases exit the secondary combustor and are carried to the waste heat boiler through a carbon steel T-section duct lined with 4 inches of castable refractory resulting in a 46 inch ID.

The vertical leg of this T-section duct is equipped with an access lid (TRV) which can be opened to vent hot gases away from the boiler and the downstream air pollution control train.

Opening the TRV is a manual operation. Either one of the following substained conditions will cause the technician to open the TRV:

(1) Low-Low Steam Drum Level--A low level in the steam drum automatically operates the AWFSO circuit to stop waste feed to the kiln. Thus prior to the actuation of a low-low alarm in the steam drum, the waste feed to the kiln has been stopped.

(2) High-High Packed Tower Inlet Temperature. A high packed tower temperature automatically opens the emergency quench water valve into the quench elbow. A high packed tower temperature automatically operates the AWFSO circuit to stop waste feed to the kiln. Thus prior to reaching the conditions which would cause an operator to open the TRV, the waste feed to the kiln has been stopped.

The TRV is in itself linked to the AWFSO system so that if it is opened the waste feed is automatically stopped. The TRV may be opened during cooldown of the incinerator. However, it is only opened after all waste in the kiln is completely processed. To accomplish that, the operators will stop waste feed and continue to operate the incinerator in henoramal mode for a minimum of two hours to ensure all waste in the kiln is processed. Only after that two hour period will the TRV be opened to facilitate a normal cooldown of the system.

The secondary combustor is equipped with four solids removal chutes to facilitate the removal of any solids during operations which were not removed by the cyclones and are carried over into and drop out in the secondary combustor. Each chute is fabricated of carbon steel, is lined with 2 inches of castable refractory, and has inlet dimensions of 10 x 14 inches. Steam lines can be connected to the discharge end of each chute to supply steam to draw solids from the chute and convey them to a solids

collection bin. Alternatively, slide gates can be installed in the chutes to control the discharge of solids into underlying collection bins. Selection of either of these options will be based on the physical properties of the solids collected in the secondary combustor.

II.C.3. Air Pollution Control Train

The air pollution control train consists of a quench system, packed tower, ejector scrubber, stack and effluent neutralization unit. This equipment train is designed to cool and remove acid and submicron particulate from the gases that exit the waste heat boiler and to neutralize the effluent generated in this train. The quench system and packed tower are installed on a skid which is located adjacent to the flat-bed trailer that holds the waste heat boiler. Drawing 7 provides plan and section views of this equipment. The ejector scrubber and stack are installed on a separate trailer, and plan and section views of the equipment are provided by Drawing 8. The effluent neutralization unit is located adjacent to the packed tower, and shown as a P&ID in Drawing 9. The P&ID of the ejector scrubber is provided in Drawing 10.

II.C.3.a. Effluent Neutralization System. The effluent neutralization system consists of a vertical 90 degree reducing quench elbow, packed tower inlet duct, and effluent neutralization tank. The neutralization system duct work conveys exit gases from the waste heat boiler to the quench elbow, past the neutralization tank to the packed tower.

The quench elbow contains several nozzles which spray recirculated water from the effluent neutralization tank into the elbow to cool and partially remove acid from the gases that exit from the wasteheat boiler. Gas temperatures are reduced from approximately 450°F to approximately 165°F. The quench elbow is fabricated of Inconel. The quench elbow has an initial inside diameter of 54 inches, (as does the inlet ductwork), and a final diameter of 30 inches at the inlet into the packed tower inlet duct.

The neutralization tank collects the recirculated water sprayed into the quench elbow (less that portion evaporated). The packed tower inlet duct conveys gases from the quench elbow to the packed tower. Collected water is drained from the packed tower inlet duct by gravity to the effluent neutralization unit. The packed tower inlet duct which conveys gases from the quench elbow to the packed tower is fabricated of fiberglass reinforced plastic (FRP).

The quench elbow is served by a recirculation line with a pair of pumps (one of which serves as a standby) which recirculate water from the effluent neutralization unit to the spray nozzles in the quench elbow. This recirculation line is equipped with a flow meter which transmits to an indicator on the control panel and the data acquisition and control computer. The line is also equipped with (1) a strainer, (2) a low pressure switch which transmits to an alarm on the control panel, (3) a pH measuring device that transmits to a controller that controls the injection of caustic into the neutralization tank, (4) pressure gages with local readouts, and (5) appropriate valving.

The quench elbow is also served by an emergency raw water line which will introduce cooling water to a spray nozzle in the quench elbow if the recirculation of water from the effluent neutralization unit is not sufficiently cooling the gasses passing through the quench system. The introduction of raw water is ordered by a high-temperature switch activated by a thermocouple in the outlet duct of the quench system. This high-temperature switch actuates a pneumatic solenoid valve which in turn actuates a valve on the emergency raw water line. The solenoid valve also can be manually operated. The emergency raw water line is equipped with appropriate valving.

Inlet gas temperatures to the quench system and packed tower are measured by redundant thermocouples in the outlet duct. One thermocouple transmits to a digital indicator on the control panel. The other thermocouple transmits to: (1) the data acquisition and control computer which displays readings on the monitor, (2) the high temperature switch that controls the introduction of emergency raw water to the quench elbow,

and (3) the high-high temperature switch shut-off to the kiln burner and secondary combustor burner fuel and activates the Automatic Waste Feed and Shut Off (AWFSO)circuits.

Outlet vacuum from the quench system is measured by a draft transmitter in the outlet duct. Measurements are transmitted to an indicator on the control panel and to the data acquisition and control computer, and also to the AWFSO circuit. Outlet vacuum is also measured by a pressure gage (with local readout) on the outlet duct.

II.C.3.b. <u>Packed Tower.</u> The packed tower is designed to remove additional acid from the gases that exit the quench system. The gases flow upward through the tower and are scrubbed by a countercurrent flow of water sprayed into the top of the tower. Scrubbing water is introduced through individual spray nozzles from three sources: (1) fresh water make-up, and (2) excess water form the scrubber sump, and (3) fresh water recirculated from the packed tower sump and the effluent neutralization tank. The capabilities exist to inject caustic into the recirculation lines in order to scrub sulfuric acid out of the gas if high-sulfur wastes are being burned. Excess water collected in the sump of the packed tower (that water which is not recirculated to the top of the tower) is pumped to the effluent neutralization tank.

The packed tower is 14 feet high and 6 feet in diameter, and is fabricated of fiberglass reinforced plastic (FRP). It is filled with approximately 6 feet of 2 inch diameter plastic packing material. A demister pad is installed above the packing. The tower is capable of receiving an additional 6 feet of packing material if the projected chlorine loading indicates it would be necessary. This option, however, is not expected to be used at the NCBC site.

The packed tower is served by: (1) a fresh make-up water line, (2) a recirculation line from the packed tower sump, and (3) a transfer line from the effluent neutralization tank (see Drawing 9). The fresh water make-up line is equipped with a flow meter which transmits to an indicator on the control panel and the data acquisition and control computer. The flow of

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fresh water make-up to the packed tower is controlled by a manual valve. Parallel with this meter is an automatic emergency water valve which is activated by a low-level water switch in the packed tower sump as shown in Drawing 9.

The recirculation line from the packed tower sump is equipped with two pumps (one as an in-line spare) which deliver sump water for both recirculation and purge (excess sump water) to the effluent neutralization tank. This line also is equipped with a flow meter which measures the combined flow of water recirculated from the packed tower sump and the effluent neutralization tank. This meter transmits to an indicator on the control panel and to the data acquisition and control computer. Recirculation flow is controlled by a manually set valve on the recirculation line.

The recirculation line from the effluent neutralization tank is equipped with two pumps (one as an in-line spare) which deliver water from the tank for both recirculation and purge to the effluent holding tanks. This line also is equipped with a magnetic flow meter which transmits to an indicator on the control panel and to the data acquisition and control computer. Recirculation flow is controlled by a manually set valve on the recirculation line.

The packed tower is served by a purge line to pump excess water from the packed tower sump to the effluent neutralization tank. This line is equipped with a pneumatically operated valve which is designed to fail open. The referenced valve is controlled by a level indicating controller which receives a signal from a transmitter that reads water levels in the packed tower sump.

Inlet gas temperatures to the packed tower are measured by the previously described thermocouples that measure outlet gas temperatures from the effluent neutralization system.

Vacuum at the outlet of the packed tower is measured by a draft transmitter in the outlet duct which transmits to an indicator on the

control panel and the data acquisition and control computer. Outlet vacuum
is also redundantly measured by a vacuum gage (with a local readout) on the
outlet duct.

II.C.3.c. Ejector Scrubber, Demister, and Stack. The ejector
scrubber is designed to remove submicron particulate and additional acid
from the gases before they are discharged through the demister and the
stack. Gases exiting the packed tower are drawn through the ejector mixing
tube by the force of steam delivered through a nozzle in the mixing tube.
The turbulence created by the unique nozzle and mixing tube design causes
the agglomeration of submicron particulate and the absorption of acid in
the water vapor supplied by the steam. This material is removed by the
removal of water vapor in the demister at the downstream end of the
scrubber.

The ejector scrubber also serves as the prime mover for the entire
system. The drawing of gases through the ejector mixing tube produces up
to 25 inches WC vacuum. This is sufficient vacuum to draw gases through
the rotary kiln, secondary combustor, waste heat boiler, and the air
pollution control train.

All the structural components of the ejector scrubber are fabricated
of fiberglass reinforced plastic.

Condensate formed and removed in the ejector scrubber and demister
drains by gravity into the scrubber sump. The condensate that falls out in
the stack drains by gravity into the scrubber sump and the scrubber water
is recirculated to the ejector scrubber. Excess scrubber water is purged
to the packed tower.

Provision is made for injecting caustic into the recirculation line
from the scrubber sump to the ejector scrubber to augment the acid removal
capacity of the ejector scrubber when needed. While this capability will
be inplace at the NCBC site, it is not expected that the option will be
utilized.

The ejector scrubber is served by a steam supply line that delivers steam from the waste heat boiler to the scrubber jet. This line is equipped with a control valve which is controlled by a pressure indicating controller to maintain a selected delivery pressure to the jet, and is designed to fail closed. A pressure transmitter in the steam supply line transmits to the pressure indicating controller and to the data acquisition and control computer. The steam supply line is also equipped with: (1) a low-pressure switch that transmits to an alarm on the control panel, (2) a pressure gage with a local readout, and (3) a thermocouple that transmits to a digital readout indicator on the control panel and the data acquisition and control computer.

The ejector scrubber is served by a recirculation line to recirculate water from the scrubber sump to the scrubber spray nozzle. This line is equipped with two pumps (one in-line spare) and a flow meter which transmits to an indicator on the control panel and the data acquisition and control computer. The line is also equipped with: (1) a low-pressure switch that transmits to an alarm on the control panel, (2) pressure gages with local readouts, (3) a pH measurement instrument which transmits a signal to the data acquisition and control computer, (4) check valves, (5) strainers, and (6) appropriate manually operated valves.

The recirculation line also delivers excess scrubber sump water to a purge line which conveys this excess water to the effluent neutralization tank. The purge line is equipped with a control valve that is activated by a level indicating controller which receives signals from a water-level transmitter on the scrubber sump. The recirculation line is served by a caustic injection line to enable the supply of caustic to the ejector scrubber, when necessary, to augment acid removal and achieve free chlorine removal. This injection line is equipped with: (1) two pumps, one of which is an in-line spare, (2) appropriate valving, and (3) a control valve which is controlled by the instrumentation that measures the pH of the stack condensate [see description in the following subsection]. The instrumentation consists of a pH probe and an indicating transmitter which transmits to the controller that governs caustic injection and to the data acquisition and control computer.

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The ejector scrubber is served by a fresh water make-up line which introduces make-up water into the recirculation line from the scrubber sump to the ejector scrubber spray nozzle. The make-up water is introduced through a control valve and a flow indicating controller which are delineated below. Overriding actuation of this control valve is also provided by a solenoid valve which is activated by a high-water-level switch on the scrubber sump to close the control valve when high water level is detected in the sump. Additional make-up water flow can be provided through a by-pass loop which is controlled by a control valve activated oy the low-water-level switch on the scrubber sump. The fresh water make-up line also is equipped with: (1) a pressure gage with local readout, and (2) a flow meter that transmits to the aforementioned flow indicating controller and the data acquisition and control computer.

The scrubber sump is equipped with a water-level transmitter that transmits to the level indicating controller that actuates the control valve on the scrubber sump purge line as described above. The sump is also equipped with high-water-level and low-water-level switches. The high-water-level switch transmits to an alarm on the control panel and to the solenoid valve that actuates shut off of flow of emergency water to the scrubber sump as described above. The low-water-level switch transmits to an alarm on the control panel and the the solenoid valve that orders additional flow of emergency water to the scrubber sump as described above. Finally, the scrubber sump is equipped with a site glass to enable visual observation of water level in the sump.

Inlet gas temperature to the ejector scrubber is measured by a thermocouple which transmits to a digital indicator on the control panel and the data acquisition and control computer. Outlet gas temperature from the demister is measured in the same manner.

Vacuum in the ejector scrubber is measured by a draft transmitter that transmits to an indicator on the control panel and the data acquisition and control computer.

Pressure differential across the demister is measured by a
differential pressure transmitter which transmits to the data acquisition
and control computer.

Stack and Gas Monitoring:

The stack is fabricated of fiberglass reinforced plastic and is 35'10"
from the trailer bed and approximately 30'10" from ground level. The stack
is equipped with sampling ports and an access platform to these ports to
facilitate sampling during demonstration tests. It has three sections.

Lower Section	ID 36 to 30 inches	Height 8'10"
Reducer Section	ID 30 inches	Height 13'6"
Upper Section	ID 30 inches	Height 13'6"

The stack is equipped with a gas sampling system that collects,
conditions, and delivers a continuous stack sample stream to oxygen, carbon
monoxide, and carbon dioxide analyzers located in the control room. These
analyzers continuously analyze the sample stream and transmit results to
the data acquisition and control computer. Additionally, the oxygen,
carbon monoxide, and carbon dioxide analyzers transmit results to strip
chart recorders to provide a redundant recording of these parameters. The
oxygen and carbon monoxide analyzers also transmit to alarms on the control
panel (a low-level alarm for oxygen and a high-level alarm for carbon
monoxide) and to the AWFSO circuit.

Stack outlet gas temperature is measured by a thermocouple that
transmits to an indicator on the control panel and to the data acquisition
and control computer.

Stack condensate is continuously sampled and analyzed for pH by a
probe assembly and analyzer on the stack. Measurements of pH are
transmitted to the pH indicator controller which controls the injection of
caustic into the ejector scrubber recirculation line. These parameters are
monitored by the data acquisition and control computer.

II.C.4. Auxiliary Components

II.C.4.a. Waste Heat Boiler and Steam Drum. The waste heat boiler is a fire tube boiler and is designed to recover heat from the gases that exit the secondary combustor and produce steam at 250 psig which is supplied to the ejector scrubber and deaerator. Steam is also available to the kiln and secondary burner nozzles for the atomization of waste fuels, but this option will not be utilized at the NCBC site. The boiler is rated at 19.6 million BTU/hour. It is designed to be operated so that tube metal temperatures are maintained above 400°F to avoid acid corrosion. It also is designed to maintain high gas velocities through the boiler tubes to avoid fouling of the tubes by particulate deposits. A P&ID for the waste heat boiler is provided in Drawing 11. The boiler is located on a flat-bed trailer along with the deaerator.

On the NCBC project, the T-section duct connecting the secondary combustor to the boiler will be equipped with water sprays to partially cool the gases flowing into the boiler. The purpose of this water spray is to cool the low melting-point particulate entrained in the gases to prevent their deposition on the face plate and in the tubes of the boiler.

Gas inlet temperatures to the boiler are determined by thermocouple instrumentation that measure the gas outlet temperature from the secondary combustor. Gas outlet temperatures from the boiler are measured by the thermocouple instrumentation that measures the inlet gas temperature to the quench elbow.

Boiler outlet vacuum is measured by a draft transmitter in the outlet duct transmits to an indicator on the control panel and to the data acquisition and control computer. Vacuum is also redundantly measured by a vacuum gage with a local readout on the outlet duct. The boiler is equipped with blowdown lines which are fed to a blowdown tank which then gravity feeds to the POTW sewer. The boiler blowdown water does not come into contact with any process gases or contaminates. Therefore, no hazardous constituents could be discharged to the POTW via the boiler blowdown.

Steam produced by the boiler is supplied from the steam drum to its several uses through the steam header. The header is equipped with a vent and a pressure measuring device which transmits to a (1) a pressure indicating controller that operates a control valve on the vent, and (2) the data acquisition and control computer.

The steam drum is served by a make-up water feed line. Make-up water flow into the drum is controlled by a control valve which is actuated by a controller that operates due to signals received from the water-level transmitter on the steam drum. This line is equipped with a flow meter which transmits to an indicator on the control panel and to the data acquisition and control computer. The steam drum is equipped with a thermocouple that transmits to an indicator on the control panel and to the data acquisition and control computer. Further, the drum is equipped with: (1) a water level transmitter that transmits to the controller that governs the introduction of make-up water to the drum and transmits to the data acquisition and control computer, and (2) high, low and low-low water level switches. Each of these switches operates an alarm on the control panel and the low and low-low water level switch connect to the AWFSO circuit. Finally, the steam drum is equipped with a vent, two pressure relief valves, a pressure gage (with local readout), and blowdown line.

II.C.4.b. Boiler Water Treatment Units. The boiler water feed pump skid consists of two boiler water feed pumps (one of which is an in-line spare) and a chemical injection system which supplies boiler chemicals to the system as specified by the boiler water treatment program. The pumps deliver treated water to the steam drum and the system is designed to produce approximately 50 gpm of zero-hardness water. The P&ID for this system is provided in Drawing 12. The NCBC project will also include a commercial unit to remove silica from the raw water that is present in the base water supply.

II.C.4.c. Ash Removal Unit. Ash and solids from the rotary kiln are discharged into a sealed breeching at the lower end of the kiln. These materials fall from this breeching into an ash receiving tank that is filled with water above the discharge lip of the breeching to provide a

water seal. Solids removed by the cyclones are also discharged into the ash receiving tank. Ash and solids are removed from the ash receiving tank by a chain drag conveyor and discharged into roll-off boxes for further ash handling. A section view of the ash removal unit is shown in Drawing 16.

II.C.4.d. <u>Effluent Settling Unit.</u> The effluent settling unit is a sealed roll-off box into which the settled solids are pumped as a slurry for further settling. The supernatant water is returned to the Effluent Neutralization System and the settled solids will be sampled and analyzed for the POHCs. The ENT solids will be held in a sealed rolloff bin until analysis shows that it is free of POHC.

II.C.4.e. <u>Effluent Holding Tanks.</u> The NCBC project includes two effluent holding tanks into which all excess water from the Effluent Neutralization System, Ash Removal System, and Effluent Settling Unit are pumped. This excess liquid receives activated carbon treatment prior to routing to either tank. Following analytical procedures, the stored liquids can be gravity drained to the POTW sewer. A P&ID of the referenced system is shown in Drawing 13.

II.D Auxiliary Fuel System Description

The auxiliary fuel that will be utilized for the NCBC project will be exclusively natural gas. The fuel is delivered to the MWP-2000 through a four inch header pipeline that is fed directly off the base main supply line. The gas will be metered and there are two points for emergency shut off on the fuel supply header feeding the MWP-2000. The natural gas flowrate to the kiln and secondary burners is indicated in the control room and is also displayed and totalized in the data acquisition and control system.

The natural gas supply lines to both burners are equipped with two redundant shut-off valves and a vent valve between the two shut-off valves. These valves, in this double block and bleed arrangement, are controlled by the kiln and secondary combustor flame supervisors which: (1) permits feeding natural gas to the burner when flame is

present, and (2) shut-off of the natural gas feed when upset conditions occur. High pressure and low pressure in the natural gas header will shut-off natural gas feed to the burners.

Detailed descriptions of the burner fuel feed system is included in Subsection I.

Every member of the NCBC Fire Department has been trained as to the location and method of gas shut-off.

II.E. Waste Feed System Description

The waste feed system to be utilized on the NCBC project is shown in plan and section on Drawing 14 and in the P&ID on Drawing 15. This system consists of the following pieces of equipment:

II.E.1. Weigh Hopper/Shredder

This equipment combination receives excavated soils, records the total weight of the soil, and then crushes it into approximately two inch chunks for conveyance to the feed hopper by conveyor.

II.E.2. Conveyor

This equipment is a covered belt type conveyor that delivers prepared soil to the feed hopper for introduction into the kiln.

II.E.3. Feed Hopper/Auger Description

The feed hopper receives the crushed material from the conveyor and funnels it into a screw auger for introduction into the kiln. The feed hopper is totally enclosed and has hinged access doors. The effective capacity of the feed hopper is 1 cu. yd. The feed auger is a 12" diameter screw with flights at a 6" pitch in the feed section. The auger is inclined into the kiln at 20° from horizontal.

The feed auger has a variable speed control which will be used to determine the feed rate to the kiln. The kiln feed rate is a function of:

1. Auger speed.

2. Bulk density of the solid waste to be incinerated, including:

    a. Type of waste and its composition.

    b. Moisture content of the waste.

3. Percentage of loading in the auger flights.

The bulk density of the waste will be determined analytically prior to the trial burn for sand and has been determined for the native soils at the NCBC. However, the determination of the percentage of auger flight loading will require field observation and development of feed curves. This may be done during clean soil test.

The auger RPM will be interlocked, and the set point for the interlock will be determined from the feed curves referenced.

II.F. Prime Mover Capacity Description

The prime mover for the MWP-2000 is a single steam powered jet venturi scrubber that was manufactured by Hydrosonics, Inc. to develop a negative pressure of 25 inches wc.

II.G. Automatic Waste Feed Shut-Off (AWFSO) Circuit Description

The control trailer/motor control center (MCC) houses the automatic waste feed shut-off (AWFSO) and the flame supervision systems servicing the kiln burner and the secondary combustor burner. Each of the referenced burners are controlled by an independent flame supervisor. These interconnected circuits are configured to handle the upset conditions detailed below.

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II.G.1. Low Oxygen in the Stack

When stack gas oxygen concentration falls below 3%, all waste feed to the kiln is switched off. Since the NCBC project involves only solid waste feed, both the kiln and secondary burners will remain on natural gas feed only. An audible alarm sounds on the control panel and the AWFSO circuit shuts off the hydraulic drive for the kiln auger feed. The AWFSO is activated by a signal from the oxygen analyzer described in Subsection H. Figure II.2 illustrates this control configuration.

II.G.2. Low Combustion Efficiency
High CO in the Stack Gas

When combustion efficiency falls below 99.9%, waste feed to the kiln is switched off by the AWFSO circuit in the same manner described above in Subsection G.1. An Audible alarm also sounds on the control panel. Figure II.2 illustrates this control configuration.

The AWFSO circuit is activated by the data acquisition and control computer which calculates combustion efficiency from carbon monoxide (CO) and Carbon Dioxide (CO_2) results received from the CO and CO_2 stack gas analyzers described in Subsection H. Combustion efficiencies are calculated on the formula: $100 \times CO_2 / [CO_2 + CO]$.

As a backup, (when carbon monoxide concentrations in the stack gases exceed 50 ppm), the shut-off of waste feed is activated as described above in Subsection G.1. These functions are also performed by the AWFSO circuit when it is activated by a signal from the carbon monoxide analyzer described in Subsection H.

II.G.3. Low Temperature in the Secondary Combustor

When the secondary combustor outlet gas temperature falls below 2100°F, the waste feed to the kiln is shut-off, and an audible alarm is sounded on the control panel. These functions are performed by the AWFSO circuit is the same manner as described in Subsection G.1 and illustrated

in Figure II.2. The AWFSO circuit is activated by one of the thermocouples
in the outlet duct of the secondary combustor as described in
Subsection H. The low temperature switch, to which the thermocouple
failure (open circuit) will cause the switch to drive to zero degrees which
activates the AWFSO AWO shuts off the waste feed. There are redundant
thermocouples located in the secondary combustor which transmit a redundant
signal to separate indicators in the control trailer and to the data
acquisition and control computer which also operates the AWFSO circuits.

II.G.4. Loss of Kiln Burner Flame
Loss of Kiln Burner Combustion Air

When there is a loss of flame in the kiln burner or there is a loss of
combustion air supply to the kiln burner, all waste feed to the kiln is
shut off. These functions are performed by the flame supervisor serving
the kiln and the AWFSO circuit. The flame supervisor receives a signal
from the flame detector when there is a loss of flame in the burner. The
supervisor also receives a signal from the combustion air blower motor when
the motor is not running.

The flame supervisor closes the two redundant shut-off valves on the
natural gas feed line and directs the AWFSO circuit to snut-off the waste
feed to the kiln. These control functions are illustrated in Figure II.3.

II.G.5. Loss of Secondary Combustor Flame
Loss of Secondary Combustor Combustion Air

When there is a loss of flame in the secondary combustor burner or a
loss of combustion air supply to the burner, all clean fuel to the
secondary is shut off, feed to the kiln burner will remain on natural gas,
and all waste to the kiln shut off. These functions are performed by the
flame supervisor serving the secondary combustor burner and the AWFSO
circuit. The flame supervisor receives a signal from the secondary
combustor flame detector when there is a loss of flame in the burner. The
flame supervisor also receives a signal from the combustion air blower
motor when it is not operating. The flame supervisor closes the two

redundant shut-off valves on the natural gas feed line and directs the AWFSO circuit to shut off the waste feed to the kiln. These control functions are illustrated in Figure II.4.

II.G.6. Low Water in the Waste Heat Boiler and Steam Drum

When the water level in the steam drum falls 4 inches below normal operating level, all waste feed to the kiln is shut off and an alarm sounded on the control panel. These functions are performed by the AWFSO circuit in the same manner as described in Subsection G.1 The AWFSO circuit is activated by the low level switch on the steam drum.

If the water level in the steam drum continues to fall and falls 7 inches below normal operating level, all natural gas feeds to the kiln and secondary combustor are shut off and an alarm sounded on the control panel. These functions are activated by the low-low level switch on the steam drum which signals the flame supervisors serving the kiln and secondary combustor and the AWFSO circuit. The kiln flame supervisor closes the redundant shut-off valves on the natural gas feed line to the kiln burner. The secondary combustor flame supervisor closes the redundant shut-off valves on the natural gas feed line to the secondary combustor burner.

Both of the control circuits explained above are illustrated in Figure II.5.

II.G.7. Low Kiln Outlet Gas Temperature

When the kiln outlet gas temperature falls below a selected value (1350°F for the NCBC project), waste feed to the kiln is shut off, and the natural gas feed to the secondary combustor is continued. These functions are illustrated in Figure II.6. They are performed by the AWFSO circuit in the same manner as described in Subsection G.1. The AWFSO circuit is activated by one of the thermocouples in the outlet duct of the kiln.

II.G.8. Low Kiln Draft

When there is more than a five second loss of draft in the kiln the waste feed to the kiln is switched off, and the natural gas feed to the secondary combustor is continued. These functions are illustrated in Figure II.6. They are performed by the AWFSO circuit in the same manner as described in Subsection G.1. The AWFSO circuit is activated by a high pressure switch on the outlet duct of the kiln.

II.G.9. High-High Packed Tower Inlet Temperature

The high-nigh packed tower inlet temperature (Approximately 210°F) shuts all fuels to the kiln burner and the secondary burner which in activities the AWFSO circuit. The AWFSO circuit shuts off all waste feed to the kiln as shown in Figure II.5.

II.G.10. Divert TEE Thermal Relief Valve (TRV)

The actuation of the TRV between the secondary combustor and tne waite heat boiler activates the AWFSO circuit to the kiln waste feed. These functions are illustrated in Figure II.7.

II.G.11. Low Flow Rate to Scrubbing System

Should the recirculation flow to the packed tower drops below 75 gpm or if the ejector scrubber recirculation flow drops below 30 gpm. The AWFSO circuit is activated and all waste feed to the kiln is hut-off. These functions are illustrated in Figure II.*.

II.G.12 Waste Feed/Auges Speed Control

Should the auger speed (RPM) exceed the predetermined setting the AWFSO circuit is activated and all waste feed to the kiln is shut-off. The auger speed set point will be calculated from the (1) bulk density of the waste feed, (2) the percent moisture in the waste feed, and (3) the amount of material contained within the feed auger flights. These functions are

illustrated in Figure II.9. This interlock will be installed and
functional prior to routine operations. During the Trial Burn, data will
be obtained to determine the speed setting. That data will be reported in
the Trial Burn Report.

II.G.13 Secondary Combustor Gas Residence Time

The secondary combustor gas residence time is calculated by the data
acquisition and control computer using the following:

$$\text{Residence time} = \frac{\text{Secondary Combustor Volume}}{[\text{Total input mass flow} \quad (\text{gas density})]}$$

$$\text{Combustion Gas Density (pounds per cubic foot)} = \frac{39.7}{\text{Sec. Combustor Outlet Gas Temp} + 460°F}$$

Should the calculated residence time fall below 1.1 seconds the AWFSO
circuit would be activated and all waste feed to the kiln is shut off.
These functions are illustrated in Figure II.10.

During the trial burn, the CO, CO_2, and O_2 gas analyzes will be
certified with NBS gases under operating conditions. Coorelation curves
utilizing the combustion gas data and maximum theoritical gas flow through
the secondary combustor will be developed. this data will be submitted to
EPA, and upon their approval, may be substituted for the aforementioned
interlock.

II.H Stack Gas Monitoring and Pollution Control Equipment

The following table delineates the plan for monitoring thermal
destruction parameters. The purpose of this monitoring is to provide data
to: (1) demonstrate compliance with authorized operating conditions and,
(2) evaluate the operation of the system.

The concentrations of oxygen, carbon monoxide, and carbon dioxide in
the stack gas are measured by extractive continuous emission monitors

TABLE II.H.1.   MONITORING OF THERMAL DESTRUCTION PARAMETERS

Parameter	Method	Frequency	Contingency[a]
Stack gas oxygen concentration	ECEM[b]	Continuous	Stop all waste feed until monitor or sampling system is repaired.[c]
Stack gas CO concentration	ECEM[b]	Continuous	Same as above
Stack gas CO_2 concentration	ECEM[b]	Continuous	Same as above
Combustion efficiency	Calculated by data acquisition computer	Continuous	[c]
Secondary outlet gas temperature	Thermocouple with zero scale burn-out	Continuous	Use the redundant thermocouple[c]
Secondary gas residence time	Calculated	Continuous	Manual calculation while repairing the computer[c]

a. If the monitoring device can be repaired within fifteen minutes, the contingency will not be implemented.

b. Extractive Continuous Emission Monitor

c. During malfunction all waste feed will be discontinued until repairs are completed.

(ECEM). The combustion efficiency and secondary combustor gas residence times are calculated by the data acquisition and control computer. The instruments used to make these measurements and calculations of thermal destruction parameters are described below.

II.H.1. Extractive Continuous Emission Monitors

The ECEM system consists of (1) three monitors that continuously analyze the oxygen, carbon monoxide, and carbon dioxide concentrations in a stack gas sample stream delivered to these monitors, and (2) a stack gas sampling system that continuously collects, conditions and delivers the stack gas sample to these monitors.

		NBS Traceable Calibration Gas		
Instrument	Range	N_2 Low	Mid	High
Teledyne O_2	0 - 25%	0%	10%	20.9%
Beckman 865 CO	0 - 100%	0%	50 ppm	99.8 ppm
Infrared CO_2	0 - 50%	0%	25%	49.9%

All calibration gas is NBS traceable and introduced at the start of each shift. The gas is injected from the control room through a o.25" PVC line to the stack where the gas sample probe is installed. This procedure ensures a check on all gas interlocks, response time of the system and provides a leak check for the gas sampling system. Each gas monitor is given a three point calibration as per the table above.

   II.H.1.a. Oxygen Monitor. The oxygen analyzer was manufactured by Teledyne Analytical Instruments and utilizes a unique Micro-fuel Cell to measure the concentration of oxygen in a gas stream. The analysis is specific for oxygen (the measuring cell will not generate an output current unless oxygen is present in the sample gas). The measuring cell has the ability of accurately responding to the presence of oxygen irrespective of flowrate. The analyzer can be calibrated using atmospheric air as a span gas.

Oxygen is consumed by the cell from the gas around it, and a proportionate micro-ampere current generated. The low level signal is then amplified by a solid-state integrated circuit amplifier and the resulting signal is sent to a recorder, a temperature compensator circuit, and an integral micro-ampere meter.

II.H.1.b. Carbon Dioxide Monitor. The carbon dioxide analyzer was manufactured by Infrared Industries and is a non-despersive infrared (NDIR) gas analyzer which is capable of continuously monitoring the CO_2 content of a gas stream.

II.H.1.c. Carbon Monoxide Monitor. The carbon monoxide analyzer was manufactured by Beckman Instruments. The CO analyzer produces infrared radiation from two separate sources and beams these separate streams through a chopper which interrupts it at 10 Hz. The detector is a "gas micropnone" on the Luft principle. It converts the difference in energy as a capacitance change which is amplified and then indicated on a meter used to drive a recorder.

II.H.2. Combustion Efficiency Monitoring

The combustion efficiency being achieved by the MWP-2000 is continuously calculated by the data acquisition and control computer from readings from the carbon dioxide and carbon monoxide monitors. This calculation is performed using the equation:

$$\% \text{ Combustion Efficiency} \frac{(CO_2)}{(CO_2 + CO)} \times 100$$

where:

(CO_2) = the reading from the carbon dioxide monitor converted to ppm,

(CO) = the reading from the carbon monoxide monitor in ppm.

This calculation is recorded in the data acquisition and control computer. If the computer malfunctions making this calculation, waste feed to the system is shut off until the malfunction is corrected.

During the operation of the MWP-2000, the on-shift technicians monitor, through the indicator devices in the control trailer, the operating conditions of all parts of the system. This monitoring will constitute a continuous inspection of the operation of the system. Through this monitoring, the technician is able to detect virtually any malfunction of the system and often will be able to foresee potential malfunctions and order their correction before they happen.

II.I. Burner and Nozzle Design

II.I.1. Rotary Kiln

The kiln is equipped with a single burner that is capable of producing 14 million BTU/hour of heat when using either clean fuel or liquid waste (waste fuel) having heating values ranging from 6000 to 19500 BTU/pound. The burner nozzle is designed to use either steam or air (as needed) to atomize the fuel of wastes being injected. The burner produces a long flame cone up to 15 feet long and 3.5 feet in diameter at the end of the flame cone. While the burner is designed to handle dirty fuel or wastes having particle sizes up to 0.125 inch, this option is not expected to be utilized on the NCBC site because natural gas will be the only fuel used.

The burner is served by a flame supervisor which manages the lighting of a pilot flame and the full flame. When lighting the pilot flame, the supervisor controls the introduction of propane or natural gas and the ignition spark is in a time sequential manner. When lighting the full flame, this supervisor controls the introduction of clean fuel when the pilot flame is lit and stable. The flame supervisor also controls the shut-off of waste or clean fuel to the burner if the upset conditions referenced in Subsection G.4 occur.

II.I.2. Secondary Combustor

The secondary combustor is equipped with a vortex burner which is capable of producing 24 million BTU/hour of heat using natural gas or other fuels having heating values from 6000 to 19500 BTU/pound. The burner nozzle is designed to concurrently introduce fuels, natural gas, and/or atomizing steam or air and is fabricated with a specialized tip for handling highly chlorinated liquid wastes. The burner is designed to produce a short (4 foot), highly turbulent flame cone. Combustion air is introduced into the burner tangentially to the create a turbulent flame. The combustion air is supplied by a blower capable of delivering 5460 cfm at 35 inches wc pressure. The burner is served by a flame supervisor that manages the lighting of the pilot and full flame and controls the shut-off of natural gas to the burner in upset conditions as detailed in Subsection G.5.

II.J. Materials of Construction for Component Modules

The materials of construction used in the ENSCO MWP-2000 were selected by the engineering staff and based on five years of operational experience. The MWP-2000 is the third generation modular incinerator built by ENSCO and is constructed of durable, proven components. Individual component segments are covered in Subsection II.C.

II.J.1. Rotary Kiln and Cyclones

The major materials of the rotary kiln are carbon steel support beams used in the fabrication of the support structure/transport trailer. The kiln shell is rolled 0.5 inch carbon steel plate and it is lined with 6 inches of high alumina fire brick.

II.J.2. Secondary Combustor

The major materials of construction for the secondary combustor is carbon steel beams used in the fabrication of the support

structure/transport trailer. The secondary combustor shell is rolled
0.5 inch carbon steel plate and it is lined with 2.25 inches of insulating
brick and 4.5 inches of fire brick.

II.J.3. Air Pollution Control Train

The air pollution control train is located on two skids and a flat bed
trailer. The major material of the effluent neutralization system is
carbon steel plate. The major material of the packed tower and the ejector
scrubber is fiberglass reinforced plastic (FRP).

II.K. Location and Description of Temperature, Pressure,
and Flow Indicating Devices

This section consists of a series of tables and a drawing that explain
and locate the instrumentation involved with the monitoring of temperature,
pressure, and fluid flow for the MWP-2000.

MONITORING OF FEED RATES AND AMOUNTS

Parameter	Method	Frequency	Location	Contingency
ROTARY KILN				
Clean fuel feed	Orifice plate flow meter	Continually[d]	1	Repair as soon possible
Solid waste feed	Calculated from weigh hopper or scale weights and time of feed	Averaged over each shift	4	Stop solid waste feed until weigh hopper or scale is repaired[c]
SECONDARY COMBUSTOR				
Clean fuel feed	Orifice plate flow meter	Continually[d]	6	Repair as soon as possible[c]

a. If the meter or measuring device can be repaired within 15 minutes, waste feed will not be discontinued.

b. Extractive Continuous Emission Monitor.

c. During any malfunction waste feed will be discontinued until the appropriate repairs are completed.

d. The term continually means the process variable is indicated on the control panel readout on a continual basis.

MONITORING OF THERMAL DESTRUCTION PARAMETERS

Parameter	Method	Frequency	Location	Contingency[a]
Stack gas oxygen concentration	ECEM[b]	Continually[d]	8	Stop all waste feeds until monitor or sampling system is repaired[c]
Stack gas carbon monoxide concentration	ECEM[b]	Continually[d]	8	Same as above
Stack gas carbon dioxide concentration	ECEM[b]	Continually[d]	8	Same as above
Combustion efficiency	Calculated by data acquisition and control computer	Continually[d]	8	c
Secondary combustor outlet gas temperature	Thermocouple	Continually[d]	9	c
Secondary combustor gas residence time	Calculated by data acquisition and control computer	Continually[d]	1,10, 6,14, 9	c

a. If the meter or measuring device can be repaired within 15 minutes, waste feed will not be discontinued.

b. Extractive Continuous Emission Monitor.

c. During any malfunction waste feed will be discontinued until the appropriate repairs are completed.

d. The term continually means the process variable is indicated on the control panel readout on a continual basis.

MONITORING OF OTHER OPERATING PARAMETERS

Parameter	Method	Frequency	Location	Contingency
ROTARY KILN				
Combustion air air feed rate	Annubar	Continually[d]	10	c
Burner flame	Flame detector	Continually[d]	11	c
Outlet gas temperature	Thermocouple	Continually[d]	12	c
Outlet pressure	Pressure transducer	Continually[d]	13	c
SECONDARY COMBUSTOR				
Combustion air feed rate	Annubar	Continually[d]	14	c
Burner flame	Flame detector	Continually[d]	15	c
Pressure drop across combustor	Differential pressure transducer	Continually[d]	16	Repair as soon as possible

MONITORING OF OTHER OPERATING PARAMETERS (continued)

Parameter	Method	Frequency	Location	Contingency
WASTE HEAT BOILER				
Outlet gas temperature	Thermocouple	Continually[d]	18	Repair as soon as possible
Pressure drop across boiler	Differential pressure transducer	Continually[d]	19	Repair as soon as possible
Steam pressure	Pressure indicator	Continually[d]	20	Repair as soon as possible
Steam drum water level	Water level switches	Continually[d]	22	c
Make-up water flow rate	Orifice plate flow meter	Continually[d]	23	Repair as soon as possible
EFFLUENT NEUTRALIZATION SYSTEM				
Recirculation flow rate	Magnetic flow meter	Continually[d]	24	Repair as soon as possible
Recirculation flow low pressure	Pressure switch	Continually[d]	25	Repair as soon as possible
Outlet gas temperature	Thermocouple	Continually[d]	27	Replace with spare thermocouple
PACKED TOWER				
Recirculation flow rate	Magnetic flow meter	Continually[d]	28	c
Recirculation flow rate from effluent neutralization tank	Magnetic flow meter	Continually[d]	29	Repair as soon as possible
Make-up water flow rate	Orifice plate flow meter	Continually[d]	30	Repair as soon as possible

MONITORING OF OTHER OPERATING PARAMETERS (continued)

Parameter	Method	Frequency	Location	Contingency
PACKED TOWER (continued)				
Sump water level	Water level switches	Continually[d]	31	Repair as soon as possible
Outlet vacuum	Pressure transducer	Continually[d]	40	Repair as soon as possible
EJECTOR SCRUBBER				
Inlet gas temperature	Thermocouple	Continually[d]	40	Replace with spare thermocouple
Outlet gas temperature	Thermocouple	Continually[d]	41	Same as above
Steam low pressure	Low pressure switch	Continually[d]	32	Use redundant pressure meter until switch is repaired
Pressure across demister	Differential pressure transducer	Continually[d]	33	Repair as soon as possible
Recirculation flow rate	Orifice plate flow meter	Continually[d]	34	D
Make-up water flow rate	Orifice plate flow meter	Continually[d]	35	Repair as soon as possible
Sump water level	Water level switches	Continually[d]	36	Use sight glass until switches are repaired
Caustic flow rate	Volumeteric measure from containers	Continually[d]	37	N/A

Parameter	Method	Frequency	Location	Contingency
EJECTOR SCRUBBER (continued)				
Sump pH	pH probe	Continually[d]	38	Manually draw samples and analyze for pH

a. If the meter or measuring device can be repaired within 15 minutes, waste feed will not be discontinued.

b. Extractive Continuous Emission Monitor.

c. During any malfunction waste feed will be discontinued until the appropriate repairs are completed.

d. The term continually means the process variable is indicated on the control panel readout on a continual basis.

TABLE III-G-1. (continued)

Parameter	Normal Set Point
Scrubber Recirculation Water Flow Rate[a]	approximately 40 gpm or as necessary to achieve required scrubber efficiency
Stack Gas Oxygen[a]	3% min. (nominal)
Stack Gas CO_2	function of combustion efficiency
HCl emissions	1.8 kg/h or 1% of HCl concentration into the scrubber, which ever is greater
Particulate matter	180 mg/dscm corrected for O_2

a. Indicates parameter is a specified permit condition.

TABLE III.I.1. EQUIPMENT/INSTRUMENT LIST

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Rotary Kiln		
Waste feed to burner, lb/min	1	Continual
Clean fuel feed, lb/min	1	Continual
Sludge feed, lb/min	1	Continual
Wastewater feed, lb/min	1	Continual
Combustion air feed, lb/min	1	Continual
Vacuum, in. water	1	Continual
Outlet gas temperature, °F	1	Continual
Liquid waste and fuel feed lines	2	Inspect for leaks. Repair if found.
Pump and strainer on operating waste fuel feed line	2	Switch feed to alternate pump. Remove and clean strainer.
Pump on operating clean fuel feed line	2	Switch feed to alternate pump.
Pump and strainer on operating wastewater feed line	2	Switch feed to alternate pump. Remove and clean strainer.
Combustion air and supple-mental air blowers	2	Check for overheated bearings and vibrations. Repair if found.
Solid waste feed conveyor and ram or screw feed	2	Inspect for visual signs of malfunction. Repair if found.
Sight glass into kiln and TV camera lens	2	Clean.
Hydraulic drive for ram or screw feed	3	Inspect hydraulic fluid level. Fill if necessary. Inspect hoses for leaks.

a. Key for frequency column: 1 = continual computer monitoring;
2 = daily; 3 = weekly; 4 = monthly; 5 = full shutdown.

TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Hydraulic drive for kiln	3	Inspect hydraulic fluid level. Fill if necessary. Inspect hoses for leaks.
Hydraulic drive for treated soil removal chain	3	Inspect hydraulic fluid level. Fill if necessary. Inspect hoses for leaks.
Feed pumps on waste fuel, clean fuel, wastewater and sludge feed lines	3	Inspect oil level. Fill if necessary.
Strainer on operating clean fuel feed line	3	Remove and clean.
Combustion air and supplemental air blowers	3	Lubricate.
Flame detector	5	Clean flame detector lens.
Propane tank serving burner pilot	3	Check tank pressure. Fill if necessary.
Burner	3	Visually inspect externally for signs of leaks, wear, overheating or damage.
Ram or screw feed	3	Inspect nuts. Tighten if loose.
Combustion air and supplemental air blowers	4	Inspect suction filters and replace cartridges if necessary.
Roller bearings	4	Lubricate.
Solid waste feed conveyor	5	Lubricate roller bearings.
Refractory	5	Inspect for loose brick, spalling, cracking, or other damage. Repair if necessary.
Burner	5	Remove and clean nozzle and inspect for wear or damage. Repair if necessary.

TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Cyclones	5	Inspect refactory for damage. Repair if found.
Treated soil removal system	5	Inspect chain drag for excessive wear. Replace if found.
Mass flow meters on fuel, wastewater and sludge feed lines	5	Calibrate.
Combustion air and supplemental air blowers	5	Inspect vanes for damage or excessive wear. Repair if found.
Secondary Combustor		
Waste feed to burner, lb/min	1	Continual
Clean fuel feed, lb/min	1	Continual
Wastewater feed, lb/min	1	Continual
Combustion air feed, lb/min	1	Continual
Pressure drop, in. water	1	Continual
Outlet gas temperature, °F	1	Continual
Liquid waste and fuel feed lines	2	Inspect for leaks. Repair if found.
Pump and strainer on operating waste fuel feed line	2	Switch feed to alternate pump. Remove and clean strainer.
Pump on operating clean fuel feed line	2	Switch feed to alternate pump.
Pump and strainer on operating wastewater feed line	2	Switch feed to alternate pump. Remove and clean strainer.

TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Combustion air blower	2	Check for overheated bearings and vibrations. Repair if found.
Burner	2	Rod center tube of nozzle.
Sight glass into combustor and TV lens	2	Clean.
Feed pumps on waste fuel, clean fuel and wastewater feed lines	3ι	Inspect oil level. Fill if necessary.
Strainer on operating clean fuel feed line	3	Remove and clean.
Flame Detector	5	Clean flame detector lens.
Combustion air blower	3	Lubricate.
Propane tank serving burner pilot	4	Check tank pressure. Fill if necessary.
Burner	4	Visually inspect externally for signs of leaks, wear, overheating or damage.
Combustion air blower	4	Inspect suction filter and replace cartridge if necessary.
Combustor	5	Clean out accumulated solids.
Refractory	5	Inspect for loose brick, spalling, cracking, or other damage. Repair if found.

TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Burner	5	Remove and clean nozzle and inspect for wear or damage. Repair if found.
Flame Detector	5	Clean flame detector lens.
Mass flow meters on waste fuel, clean fuel and wastewater feed lines	5	Calibrate.
Oxygen monitor	5	Check fuel cell. Replace if required.

a. Key for frequency column: 1 = continual computer monitoring;
2 = daily; 3 = weekly; 4 = monthly; 5 = full shutdown.

II.L.   DRAWING LIST FOR SECTION II

Drawing 1   General Arrangement of Equipment on the NCBC site

Drawing 2   Plan and Section View of Rotary Kiln

Drawing 3   Plan and Section View of the cyclones

Drawing 4   P & ID for the kiln

Drawing 5   Plan and section view of the SCC

Drawing 6   P & ID for SCC

Drawing 7   Quench System and Packed Tower

Drawing 8   Plan and Section of Jet Scrubber

Drawing 9   P & ID of the Packed Tower/Effluent Neutralization Tank

Drawing 10   P & ID of the Ejector Scrubber System

Drawing 11   P & ID of the Waste Heat Boiler System

Drawing 12   P & ID for the boiler water make-up unit

Drawing 13   P & ID of the Effluent Handling System

Drawing 14   Plan and section view of the Solids Feed System

Drawing 15   P & ID of the Solids Feed System

Drawing 16   Section view of the Solids Removal System

SECTION III
TRIAL BURN PROCEDURES

III.A. POHC Selection Rationale

III.A.1. Hexachloroethane (HCE)

Hexachloroethane was selected as a POHC primarily as a result of its low heat of combustion value (0.47 kcal/g.) Of the Appendix VIII (40 CFR 60) compounds, HCE is ranked third on the EPA's list ranking the incinerability of organic hazardous constituents on the basis of heat of combustion. HCE is the highest ranked solid compound by this same system. HCE is a solid below 186°C, and has a low vapor pressure which will reduce fugitive emissions and provide maximum flexibility during waste preparation. Additionally, HCE can be detected using the same analytical procedures (SW-846-8270, Capillary Column GC/MS) as trichlorobenzene, the other POHC designated for the NCBC Trial Burn.

III.A.2. Trichlorobenzene (TCB)

TCB will be the second POHC, for purposes of demonstrating 99.9999% DRE on the MWP-2000 system. Trichlorobenzene was selected as the second POHC because this compound has a heat of combustion value (3.4 kcal/g) that is very close to TCDD (3.43 kcal/g), and has favorable physical and chemical properties. The toxicity of this compound and low vapor pressure were also considerations.

Physical and chemical characteristics of these surrogate POHCs can be compared to NCBC soil constituents in Table III.A.1.

III.B. Waste Preparation

As described in Section III.A, HCE and TCB are proposed as the POHCS for both tests. Successful incineration of these compounds with a destruction and removal efficiency (DRE) of >99.9999% will demonstrate

TABLE III.A.1. PHYSICAL/CHEMICAL COMPARISON OF COMPOUNDS

Chemical Name Units	Abbr.	B.P. (C)	M.P. (C)	Phase (S,L)	Hc (kcal/g)	M.W. (g)	V.P. (mm Hg)	Other Names
Hexachloroethane	HCE	186	187	S	0.46	237	0.4	Perchloroethane
Hexachlorobenzene	HCB	323	230	S	1.79	284	0.00001	--
2,4,5 TCPAA	245T	--	157	S	2.87	256	--	2,4,5-T
2378 TCDD	TCDD	>700	305	S	3.43	322	--	TCDD, Dioxin
2,4 DCPAA	24D	160	140	S	3.62	221	--	2,4-D

that the Ensco Mobile Processing System (MPS-2000) can meet regulatory performance standards for F020 though F023 listed wastes.

The solid matrix selected for both trial burn tests is a washed, graded sand material (such as sandblasting sand). This is preferred over the NCBC soil for two reasons: (1) so that dioxin waste is not processed before an acceptable DRE has been conclusively shown, and (2) so that analytical interferences are minimized. The use of a locally available sand material that is physically similar to the native NCBC sandy loam is also important.

The soil surrogate material will be physically blended with a precise quantity of POHCs, so that a nominal POHC concentration of 1500 ppm is achieved. Blending will be accomplished as a batch operation, with spiked feed stock either produced in one bulk operation or several discrete operations depending on the capacity of the mixer.

The target POHC feedstock concentration that will assure a DRE calculation of >99.9999% (based on a 2 hour minimum time and routine MM5 detection limits) is 1500 ppm for each POHC identified in Section III.A. Because higher concentrations will not compromise or degrade system performance, the actual bulk recipe for POHC addition will be at least twice this nominal value. The bulk recipe will be determined in the field, but will be well documented so that bulk qunatities and analytical results can be compared.

Considering POHC loadings of up to 10,000 ppm each, the BTU and chlorine loadings are still well below levels that would warrant mechanical or operational modifications to the Mobile System.

III.C. Solids Handling and Feed

Approximately 36 tons of clean sand (for shakedown) and 220 tons of surrogate spiked sand will be processed during these tests.

The POHCs will be batch mixed with the sand in a cement mixer. For each 9 cubic yard batch, at least 50 pounds of each POHC will be placed into the sand mixture in 4 discrete portions. This recipe will give a POHC concentration of 1500 to 3000 ppm. Between each portion, the mixer will be operated for approximately 10 minutes. After the final portion is added, the mixer will be operated for an additional hour to ensure a homogeneous mixture of sand and surrogate.

Approximately 25 batches of sand will be prepared.

The mixture will then either be stored in temporary tents or plastic lined staging piles or placed directly into the weigh hopper for processing.

The spiked feed matrix will be placed in a weighing hopper, then fed to the mobile system via the feed conveyor system. Feedstock sampling will be accomplished as the material is moved up this conveyor, as detailed in Section III.D.

III.D. Sampling Procedures

III.D.1. Sampling Locations

To evaluate the effectiveness of ENSCO's incinerator for treating a solid matrix containing hexachlorobenzene (HCB) and hexachloroethane (HCE), Versar will collect the following samples for each of the six runs proposed in this trial burn plan:
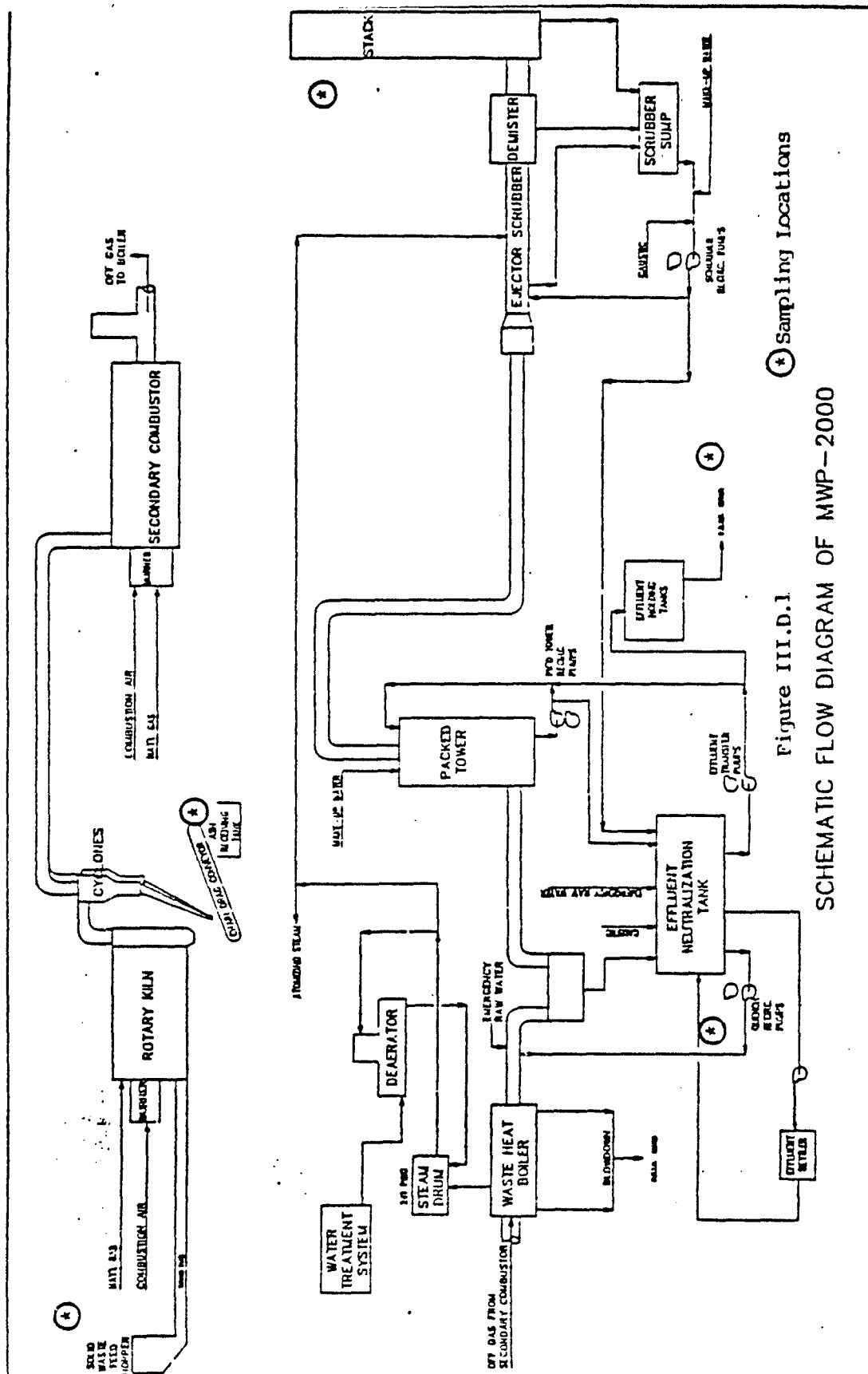
o   Feedstock matrix

o   Treated solid residues

o   Stack gas

o   Neutralization tank (after each run)

o   Neutralization tank (after adsorption)

III-4

o   Neutralization tank background

o   Blanks.

Figure III.D.1 is a schematic diagram of the MWP-2000 incinerator showing
the locations where each of the above samples will be obtained. Feedstock
matrix samples will be obtained from the conveyor before the untreated
solids are transferred to the hopper. Solid residues will be sampled as
they fall off of the ash drag conveyor before the untreated solids are
transferred to the hopper. Solid residues will be samples as they fall off
of the hopper. Solid residues will be sampled as they fall off the ash
drag conveyor into the solids collection bin. Stack gas samples will be
obtained on the stack via two 4 inch flanges which are located 90 degrees
apart approximately 6 feet before the top of the stack. Two different
types of neutralization samples will be obtained. After the completion of
each run (there are three runs per test) a grab sample will be obtained
from a sample port located on the effluent neutralization tank
recirculation pump. After all six runs have been completed, the final
neutralization tank sample will be obtained from a sample tap immediately
after the water exits carbon adsorption but before the POTW holding tanks.
Before any tests begin, a background sample will be taken from the effluent
neutralization tank via a sample port located on the recirculation pumps.
A blank water sample will be obtained from a supply water tap. Blank
samples for stack gas sampling are described in the Quality Assurance
Project Plan. A blank composite sample of the solid matrix for this test
will be obtained from several fresh bags of sandblasting sand selected at
random.

III.D.2.   Sampling Collection Procedures

III.D.2.a.   Feedstock Matrix.   Samples of the feedstock matrix for
each run will be collected from the conveyor as the sand mixture is
transferred to the weigh hopper. Samples will be obtained by taking grab
samples every 15 minutes during the run. A small clean sample scoop will
be used to obtain each grab sample. Each 15 minute sample will consist of
three sixteen ounce jars which will be filled by taking approximately nine

Figure III.D.1.

SCHEMATIC FLOW DIAGRAM OF MWP-2000

(*) Sampling Locations

grab samples at different locations across the width of the conveyor belt. After the jar is filled, it is emptied into a clean wheel barrow for temporary storage. A representative composite sample will be prepared by homogenizing the equal portions of 15 minute samples after the run has been completed. Homogenization will be performed manually by mixing the samples together using a ring and cone pattern with the sample scoop in the wheel barrow. After homogenizing, the samples will be placed in clean jars with Teflon-lined lids. As required, sample splits will be provided to EPA or their designated onsite representative.

III.D.2.b. <u>Treated Solid Residue</u>. Grab samples of treated residue from the ash drag sump will be obtained using a small clean sample scoop to catch samples as the residue falls off of the ash drag conveyor into the ash drag bin. Samples for each run will be collected every 15 minutes. Care will be exercised to collect individual grab samples from various locations in the residue stream. Each 15 minute sample will consist of three sixteen ounce jars which will be filled as the individual grab samples (approximately nine grab samples are needed to fill the three-sixteen ounce jars) are taken. The jars will be emptied into a clean stainless steel bucket which will be stored inside a large clean plastic bag (to prevent cross contamination) when not being filled or emptied. A representative composite sample will be prepared by manually homogenizing the grab samples for each run with the sample scoop in the stainless steel bucket after each test. After homogenizing, samples will be placed in clean jars with Teflon-lined lids.

III.D.2.c. <u>Stack Gas</u>. During all runs two different EPA method 5 stack sampling trains will be used. The first will be a modified method 5 train (see Figure III.D.2) which will be used to sample for potential Principal Organic Hazardous Constituents (POHC's), which were described earlier in this trial burn plan. The second sampling train will independently quantify the amount of particulate captured and concentration of HCl in the stack gases.

The first sampling train used, a modified method 5 (MM5), and its operation will be in accordance with SW-846 procedures (Method 0010). As shown in Figure III.D.2, a total of 4 impingers will be used. Because the stack gases will be saturated, the first impinger will be large enough to capture 2 liters of condensate. To minimize the chance of field cross contamination, the XAD modules will be filled at the laboratory after the XAD has been cleaned. The sealed modules will only be opened for insertion and removal from the MM5 train.

The second train, a regular method 5 (M5), will be set up to capture particulate and determine HCl concentration. For that reason it will not require an XAD module, as did the MM5 train, and the second impinger will be loaded with an alkaline solution (100 mL of 0e1 normal NaOH) for chlorides determination; otherwise it will look exactly the same as the MM5 train. As is the case with the MM5 train, four impingers will be used and the first impinger will be large enough to collect 2 liters of solution. Prior to sampling the first impinger will also be loaded with 100 mL of 0.1 N NaOH. The particulate filter in the second sampling train will only be used to quantify the amount of particulate captured along with the probe rinsate (i.e., total particulate will be determined based on the particulate collected on the filter and any particulate in the probe rinsate). The following procedure will be used to accomplish this test objective:

Step 1: Particulate filters will be dryed in a clean desiccant box for a minimum of 24 hours.

Step 2: Each filter will be pre-weighed and weight will be recorded.

Step 3: The filter will be used in the second MM5 train.

Step 4: The filter will be carefully removed from its glass container and placed in a clean desiccant box for 24 hours.
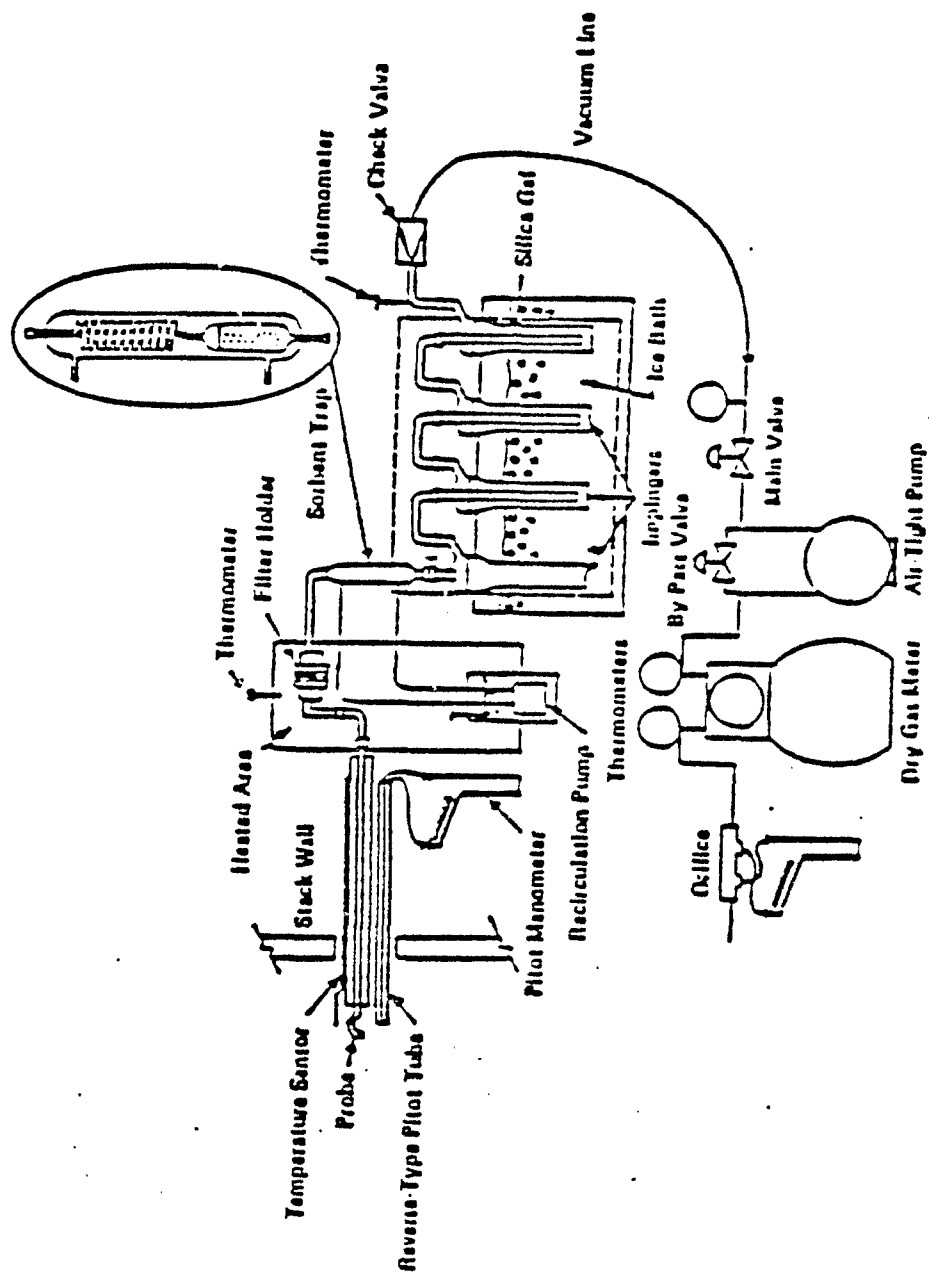
Step 5: The filter will be weighed.

Figure III.D.2   Modified Method 5 Sampling Train (1735)

Step 6:   The filter will be dryed for an additional 8 hours in the
          desiccant box.

Step 7:   The filter will be reweighed to confirm no additional weight
          loss.

Step 8:   The filter will be discarded.

All drying will be performed at room temperatures (i.e., nominally 70°F) in
a clean desiccant box constructed of stainless steel and glass. The
desiccant box will be placed inside one of the sample trailers located
onsite at NCBC which will be maintained at room temperature. Approximately
500 grams of silica gel will be placed in the desiccant box as a drying
agent, which will be replaced as required.

The probe rinsate for the M5 train will be collected for each run and
sent to the analytical lab for particulate captured can be determined by
adding the amount captured from the particulate filter to the amount
contained in the probe rinsate.

A deviation from protocol [EPA Reference Method 1 (40 CFR 60,
Appendix A)] for the M5 train will be the use of acetone instead of the
recommended 1:1 mixture of methylene chloride and methanol as a probe
rinsate. Because part of the M5 procedure will be to quantify HCl
concentrations in the stack gas (the second impinger will be used for
this), the use of methylene chloride would give a positive bias for
chlorides determination. For that reason acetone was chosen as the rinsate
solution.

The sampling location and number of traverse points for the MM5 and M5
sampling has already been determined after a presurvey which was performed
according to procedures established in EPA Reference Method 1 (40 CFR 60,
Appendix A). Based on an inside stack diameter of 30 inches (see
Section 2) and the fact that the sampling ports are greater than eight
stack diameters downstream of any flow disturbances, six sampling point
locations were established on two perpendicular stack cross sections as

shown in Figure III.D.3. Because two different trains must be operated simultaneously, the MM5 train will begin sampling at location number 1 while the M5 begins at location number 12 (or vice versa).

Stack gas moisture and velocity will be determined concurrent with the MM5 sampling activity using procedures established in EPA Reference Method 4 (40 CFR 60, Appendix A). Stack gas molecular weight will also be determined concurrently according to procedures established in Reference Method 3 (40 CFR 60, Appendix A). During each test, carbon dioxide, carbon monoxide and oxygen content in the stack gases will be measured a minimum of three times using an Orsat-type device.

As was the case with the Verification Test Burn, actual calibration and in-field data logs will be maintained on a portable computer for ease of reference and data collection and reduction. An example of the information to be recorded for each stack gas sampling episode is shown in Table III.D.1.

The samples to be recovered from the MM5 train will be as follows:

o   Particulate filter--The filter will be carefully removed from its glass holder and placed in a clean petri dish which will be sealed with Teflon tape.

o   Probe rinse--The nozzle, probe, and front half of the filter holder and any connecting glassware will be brushed and rinsed with acetone and the rinsate will be collected in glass jars with Teflon-lined lids.

o   Condensate--The liquid contents of the impingers will be volumetrically measured and placed in glass sample bottles capped with Teflon-lined lids. Rinsing will be performed using deionized water.

o   Sorbent traps--The ends of the XAD tubes will be sealed upon removal from the train, wrapped in clean aluminum foil, placed in glass tubes and sealed.
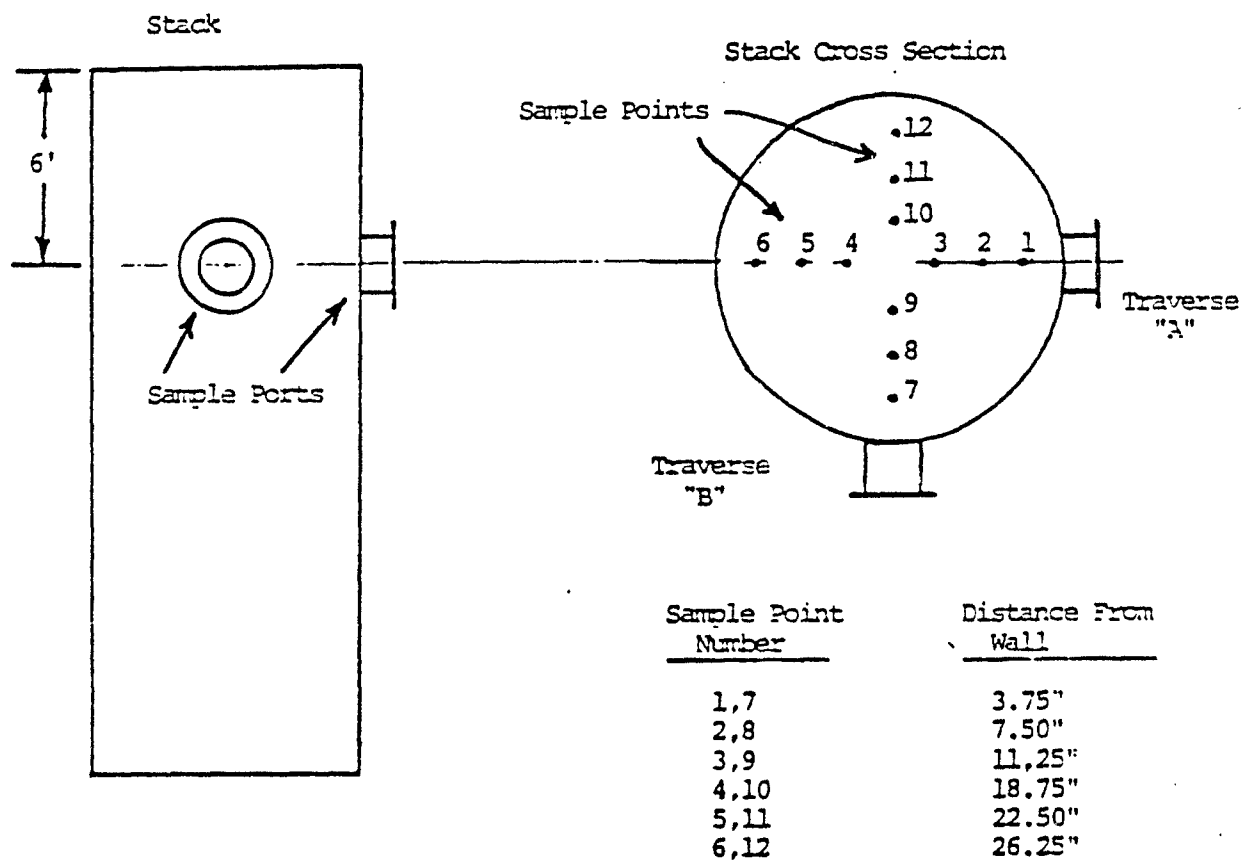
Stack

Stack Cross Section

Sample Points

6'

Sample Ports

Traverse
"A"

Traverse
"B"

Sample Point Number	Distance From Wall
1,7	3.75"
2,8	7.50"
3,9	11.25"
4,10	18.75"
5,11	22.50"
6,12	26.25"

Figure III.D.3
Modified Method 5 Sampling Locations

Table III.D.1

MODIFIED METHOD 5 AND VOST TEST DATA SUMMARY

1. NCBC - GULFPORT

2. TEST RUN DESIGNATION -   TEST 1

3. TEST DATE -   26-Dec-86

DATA DESCRIPTION	ID	MODIFIED METHOD 5 Value	Units	VOST Value	Units
4. Time					
Start	Time(s)	1339	hrs	1348	hrs
Finish	Time(f)	1456	hrs	1528	hrs
Duration	T	68	min	68	min
5. Total Number of Sampling Points	NP	12		2	
6. Meter Calibration Factor	Y	0.994		NA	
7. Orifice Calibration Factor	Ha	1.613		NA	
8. Nozzle Specifications					
Diameter	Dn	0.375	in	6	mm
Area	An	7.67E-04	ft2	NA	
9. Pitot Tube Coefficient	Cp	0.801		NA	
10. Average Orifice Pressure Drop	Havg	2.229	in H2O	NA	
11. Volume of Dry Gas Sampled	Vm	51.976	ft3	54.818	liter
12. Average Gas Meter Temperature	Tm	559.5	R	325.1	K
13. Barometric Pressure	Pb	30.46	in Hg	773.7	mm Hg
14. Static Stack Pressure	Pg	-0.42	in H2O	-10.7	mm H2O
15. Absolute Stack Pressure	Ps	30.43	in Hg	772.9	mm Hg
16. Volume of Gas Sampled (Standard)	Vmstd	49.865	SCF	50.326	liter
17. Volume of Water Collected in Impingers and Silica Gel	Vlc	663	ml	NA	
18. Volume of Water Collected Based on Saturated Conditions.	Vlc'	1822	ml	NA	
19. Volume Water Vapor Condensed in Impingers	Vwc	29.75	SCF	NA	
20. Volume Water Vapor Condensed in Silica Gel	Vwsg	1.47	SCF	NA	

Table III.D.1 (continued)

21. Percent Moisture by Volume	Bws	28.50%		NA	
22. Percent Moisture by Saturation	Bws'	49.11%			
23. Mole Fraction of Dry Gas	Fsd	0.5389		NA	
24. Gas Analysis					
Average CO2 by Volume	CO2	9.33	%	NA	
Average O2 by Volume	O2	6.13	%	NA	
Average CO by Volume	CO	0.00	%	NA	
Average N2 by Volume	N2	84.50	%	NA	
25. Dry Molecular Weight of Stack Gas	Md	29.73	lb/lb-mole	NA	
26. Molecular Weight at Stack Conditions	Ms	23.38	lb/lb-mole	NA	
27. Average Stack Temperature	Ts	644	R	357.4	K
28. Average Stack Gas Velocity	Vs	56.59	ft/sec	17.29	m/sec
29. Stack Area	As	706.9	sq-in	0.456	sq-m
30. Actual Stack Gas Flowrate	Gs	999,381	ACFH	28,319	ACMH
31. Dry Stack Gas Flowrate (Standard)	Gsstd	424,753	SCFH	12,329	SCMH
32. Iso - Kinetic Rate		75.6	%	NA	
33. Weight of Filterable Particulates	Mn	24.1	mg	NA	
34a. Particulate Concentration (at standard conditions)	Cs	1.37E-09	lb/DSCF	NA	
		0.48	mg/DSCF	NA	
		0.007	gr/DSCF	NA	
		17.065	mg/DSCM	NA	
34b. Particulate Concentration (corrected to 6% oxygen)	Cs6%O2	1.07E-09	lb/DSCF	NA	
		0.49	mg/DSCF	NA	
		0.008	gr/DSCF	NA	
		17.210	mg/DSCM	NA	
34c. Particulate Concentration (corrected to 12% carbon dioxide)	Cs12%CO2	1.36E-09	lb/DSCF	NA	
		0.62	mg/DSCF	NA	
		0.010	gr/DSCF	NA	
		21.844	mg/DSCM	NA	
35. Pollutant Mass Rate	PMR	4.53E-04	lbs/hr	NA	
		205.3	g/hr	NA	
		3168	gr/hr	NA	

Table III.D.1 (continued)

METER BOX CALIBRATION   04-Dec-86

Baro. Pressure   28.21   Meter Box No.   2577/679

Used for: TEST 1

Orifice Mano. Setting (H) (in H2O)	Gas Volume Reference (Vw) (ft3)	Gas Volume Sampler (Vd) (ft3)	Reference (tw) (F)	Inlet (td1) (F)	Outlet (tdo) (F)	Avg (td) (F)	Time (θ) (min)	(Ys)	(Ha) (in H2O)
0.5	4.310	5.075	70	82	71	76.5	11.43	0.978162	1.488641
1	5.205	5.237	70	88	74	81	8.63	0.973166	1.617355
2	10.310	10.420	70	102	78	90	12.25	0.992074	1.685389
4	10.008	10.257	70	107	82	94.5	8.76	1.010088	1.529042
6	10.307	10.212	71	110	84	84	7.17	0.989466	1.675253
8	10.010	10.144	70	110	86	98	6.27	1.019079	1.557994

                                    Avg ——) 0.993653 1.612565

CALIBRATION OF "S" TYPE PITOT TUBE   04-Dec-86

Used for: TEST 1

	Pitot Tube	Std Pitot Tube (P)	"S"-Type Pitot Tube (P)	(Cp)		Pitot Tube ID. X & Y
Test 1	X	0.56	0.79	0.834		Std Pitot (Cp) 0.99
Test 2	X	0.57	0.88	0.797		
Test 3	X	0.58	0.92	0.786		Bar. Pressure
Test 4	X	0.58	0.92	0.786		30.46
	Avg (Cp) for Probe X ——)			0.801		Gas Temp (F) 176
Test 1	Y	NOT	NOT	ERR		
Test 2	Y	IN	IN	ERR		
Test 3	Y	USE	USE	ERR		
Test 4	Y			ERR		
	Avg (Cp) for Probe Y ——)			ERR		

Table III.D.1 (continued)

INITIAL STACK TEST DATA   Report Date:
=========================   05-Jan-87

(fill-in data marked by arrows)

1 —)	Facility		NCBC
2 —)	Location		Gulfport, Mississippi
3 —)	Operator & Test Personnel		Jung Juergens, Grasso Basko Buela
4 —)	Test Date		06-Dec-35
5 —)	Run Number		TEST 1
6 —)	Stack Dia (in.) Stack Area (in2)	(A)	30 786.85834706
7 —)	Sample Box Number		#1
8 —)	Meter Box Number		#1
9	Orifice Calibration	(Ha)	1.6126659758
10	Gas Meter Cal. Factor	(Y)	0.9936593475
11	Pitot Constant (Probe X) (Cp) Pitot Constant (Probe Y) (Cp)		0.3086811727 ERR
12 —)	Air Temperature (F)		68
13 —)	Meter Temperature (Fahrenheit)	(Tm)	66
14 —)	Prelim. Stack Temp. (Fahrenheit)	(Ts)	176
15 —)	Barometric Pressure (in. of Hg)	(Pb)	30.46
16	Moisture, Assumed	(Bws)	0.491135916
17	Mol. Weight, Dry	(Md)	29.68
18	Mol. Weight, Stack	(Ms)	23.943532592
19 —)	Meter Pressure (in. of H2O)	(Pm)	30.46
20 —)	Stack Pressure, Static (in. of H2O)	(Pg)	-0.42

Table III.D.1 (continued)

MOISTURE AND MOLECULAR WEIGHT DETERMINATION

(fill-in data at each arrow)

Test Date:		06-Dec-86
Report Date:		05-Jan-87

Stack Temp., Dry Bulb (F)	——)	179
Stack Temp., Wet Bulb (F)	——)	179
Barometric Pressure (in of Hg)	——)	28.46
Saturated H_2O Vapor Pressure at Wet Bulb Temperature (From Vapor Pressure Chart)	——)	14.96
Vapor Pressure of H_2O at Stack Conditions		14.96
Moisture Content in Stack, (Bws)		0.4911259 49.11%
CO2 in % (Orsat of Fryite)	——)	9
O2 in % (Orsat of Fryite)	——)	6
N2 in % (Orsat of Fryite)	——)	85
CO in % (Orsat of Fryite)	——)	0
Dry Molecular Weight, (Md)		29.68
Wet Molecular Weight, (Ms)		23.94

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Table III.D.1 (continued)

21	Stack Pressure, Absolute (Ps) (in. of Hg)			30.43
22	X Factor (H = K x P)	(K)		4.5899622699
23 —)	Reference P (in. of H2O)	(Pavg)		0.3567
24	Nozzle Dia (Calculated)			0.3780928196
25 —)	Nozzle Dia (Actual)	(Dn)		0.375
26	Nozzle Area (ft2)	(An)		0.0007669984
27 —)	Nozzle Number			#1

28 —) Leak Rate (@15in Vacuum)				
	Initial (ft3/min)			0.001
	Final (ft3/min)			0.006

		No.	S-7	
29a —)	Filter Weights (grams)	Final		0.6255
		Initial		0.6014
		Diff.		0.0241

		No.	Not Used	
29b —)		Final	_____	
		Initial	_____	
		Diff.		ERR

30a —)	VOST Sorbent	Tenax	17939
		T/Char	17940
30b —)	VOST Sorbent	Tenax	17941
		T/Char	17942
30c —)	VOST Sorbent	Tenax	17943
		T/Char	17944

31a —) Moisture-Impinger #1	ml		816
31b —) Moisture-Impinger #2	ml		16
31c —) Moisture-Impinger #3	ml		0

31d —) Moisture-Silica Gel	Final		242.0833
	Initial		210.9
	Diff.		31.1833

31e —) Moisture-Total	(ml)		863.1833
(excluding NaOH)	(ml)		663.1833
Moisture-Saturation	(ml)		1022

31 —) Sample Container(s) No.			_____
			_____
			_____

Table III.D.1 (continued)

32 —)	Remarks	184 ml of NaOH carryover to impinger #1.
		Liquid was lost due to overflow in impinger #1. Since flue gas stream was saturated, actual of moisture collected should have been 1822 ml.

Table III.D.1 (continued)

STACK TEST DATA TEST 1 06-Dec-86

Report Date: 05-Jan-87

Traverse Point Number	Time (min)	Clock Time (24 hr)	Gas Meter Reading (Vm) (ft3)	Pitot Pressure (P) (in H2O)	Orifice Meter Pressure, (H) (in of H2O) Desire	Actual	Temperature Dry Gas Meter (F) Inlet	Outlet	Vacuum (in Hg)	Oven Temp. (F)	Imping Temp. (F)	Stack Temp. (Ts) (F)	CO2 (%)	O2 (%)	
1	7	Start	1339	244.185	0.66	3.03	3.4	83	71	13		50	182			1
2	8	5	1344	250.4	0.57	3.08	2.55	100	74				183			2
3	9	10	1349	254.9	0.77	3.53	2.3	109	79	22			183	10	6	3
4	10	15	1354	259.9	0.68	4.04	2.7	116	82	22.5			183			4
5	11	20	1359	264.3	0.91	4.18	2.6	120	86	23	222	91	183		6	5
6	12	25	1405	269.6	0.88	4.04	2.45	126	90	23	240	85	183	9.5		6
7	1	30	1426	272.945	0.53	2.56	1.6	98	90	24	240	78	184			7
8	2	35	1431	276.3	0.59	2.71	1.75	110	92	24	255	75	184			8
9	3	40	1436	280.7	0.7	3.21	1.7	114	92	24	240	74	184			9
10	4	45	1441	284.5	0.66	3.35	1.7	120	94	24	243	41	184		5.5	10
11	5	50	1446	288.4	0.92	4.22	1.55	122	96	24	270	88	184	9		11
12	6	55	1451	292.6	0.37	3.99	1.55	124	100	24			183			12
13	6	60	1456	295.161			0.00						183	9	7	13

Sampling Duration
(min) —   60

Gas Sample Vol (ft3)(Vm) —) 51.976

	Pitot Pressure (in H2O) (P)	Orifice Meter Pressure, (in of H2O) (H)	Dry Gas Meter Temp. (F) (Tm)	Vacuum (in Hg)	Oven Temp. (F)	Imping Temp. (F)	Stack Temp. (Ts) (F)	CO2 (%)	O2 (%)
Average ———)	0.774	2.229	99.5	22.50	244.3	72.3	183.3	9.4	6.1
Minimum ———)	0.550	1.550	71.0	13.00	222.0	41.0	183.0	9.0	5.5
Maximum ———)	0.920	3.400	126.0	24.00	270.0	91.0	184.0	10.0	7.0

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Table III.D.1 (continued)

MODIFIED METHOD 5 CALCULATED DATA   TEST 1   Test Date: 06-Dec-86
Report Date: 05-Jan-87

Average Pitot Pressure (Pavg) (in H2O)	Average Stack Temp. (Ts) (R)	Average Orifice Pressure (Havg) (in H2O)	Average Meter Temp. (Tm) (R)	Average Stack Gas Velocity (vs) (ft/sec)	Volume of Gas Sampled at STP (Vm(std)) (dscf)	Vol. Flowrate at Stack (Qs) (ACFH)	Vol. Flowrate at STP (Qstd) (SCFH)	Iso-Kinetic (%)
0.660	642.0	3.40	557.0	NA	NA	NA	NA	NA
0.665	642.5	3.13	542.0	52.413	6.163	9.25E+05	3.94E+05	128.33
0.700	642.7	3.02	546.0	53.782	10.554	9.53E+05	4.34E+05	101.64
0.745	642.8	2.94	549.3	55.407	15.384	9.81E+05	4.17E+05	97.33
0.778	642.8	2.37	552.0	56.725	19.598	1.00E+06	4.26E+05	91.76
0.795	642.9	2.38	554.7	57.223	24.623	1.01E+06	4.31E+05	91.39
0.764	643.0	2.63	554.6	56.212	27.064	9.93E+05	4.22E+05	85.98
0.743	643.1	2.52	555.4	55.418	31.545	9.79E+05	4.16E+05	83.05
0.738	643.2	2.43	556.2	55.238	35.255	9.76E+05	4.15E+05	81.54
0.750	643.3	2.36	557.3	55.697	38.342	9.84E+05	4.16E+05	79.31
0.765	643.4	2.29	558.4	56.270	42.512	9.94E+05	4.22E+05	78.49
0.774	643.3	2.23	559.5	56.588	46.449	1.00E+06	4.25E+05	77.81
0.774	643.3	2.23	559.5	56.587	49.365	1.00E+06	4.25E+05	76.46

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Table III.D.1 (continued)

VOST TEST DATA TEST 1 06-Dec-86

Report Date: 05-Jan-87

	Samplin Time (min)	Clock Time (24 hr)	Gas Meter Reading (liter)	Rota-meter Setting	Vacuum (in Hg)	Meter Temp. #5 (C)	Probe Temp. #1 (C)	Meter Temp. #5 (F)	Probe Temp. #1 (F)
1	Start	1348	8970.5	75	22	53	155	127.4	307.4
2	5	1353	8975.5	76	22	51	155	122.8	311
3	10	1353	8979.9	73	21	49	156	120.2	312.9
4	15	1403	8984.4	75	23	50	159	122	318.2
5	20	1417	3988.65	77	17	51	130	123.9	265
6	25	1422	8993.7	80	7	51	125	122.3	257
7	31	1427	8999.5	60	7	53	150	127.4	362
8	35	1432	9002.7	52	15	53	155	127.4	311
9	40	1500	9006.31	80	6	54	159	129.2	318.2
10	45	1525	9011.7	80	11	53	155	127.4	311
11	50	1510	9015.2	75	13	53	155	127.4	311
12	55	1515	9020.3	80	14	54	155	129.2	312.8
13	60	1520	9025.31						

Gas Sample Volume
(liter) ———) 54.31

Sampling Duration
(min) — 60

	Rota-meter Setting	Vacuum (in Hg)	Meter Temp. (C)	Probe Temp. (C)	Meter Temp. (F)	Probe Temp. (F)
Average	76.3	14.3	52.1	152.7	125.8	303.2
Minimum	62	6	49	125	120.2	257
Maximum	90	23	54	159	129.2	318.2

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o   Silica gel--The cartridge will be returned to its original
     container and sealed after it has been weighed. The weight is
     needed to determine the amount of residual moisture that may have
     reached this cartridge.

The samples to be recovered from the M5 train will be as follows:

o   Particulate filter--The particulate filter will be carefully
     removed from its glass holder and weighed according to the
     procedure described earlier.

o   Probe rinse--The nozzle, probe, and front half of the filter
     holder and any connecting glassware will be rinsed with acetone
     and the rinsate will be collected in glass jars with Telfon-lined
     lids. The probe rinse will be analyzed for total particulate
     only.

o   HCl Impinger--The contents of the impingers will be
     volumetrically measured and placed in a glass sample bottle with
     a Teflon-lined lid.

     III.D.2.d. Effluent Neutralization Tank. Prior to all runs, a
background sample of the water in the effluent neutralization tank will be
obtained from a sample port located on the effluent neutralization tank
recirculation pumps.

     At the completion of each run, a grab sample of the water in the
effluent neutralization tank will be obtained via a sample port located on
the effluent neutralization tank recirculation pump. The sample port will
be emptied of any potentially stagnant liquid and four 1-quart amber
bottles with Telfon-lined lids will be directly filled from the sample port.

     The final neutralization tank sample will be collected via a sample
port located immediately after carbon adsorption treatment but before the
POTW holding tanks. Prior to sample collection the port will be emptied of
any potentially stagnant liquid. For the six proposed runs, water would

not normally be required to be run through the carbon beds and discharged to the POTW (i.e., the chlorine content for these tests will not produce a salt loading in the effluent neutralization tank such that water discharge and thus makeup is required). For this reason, only enough water will be run through the carbon beds and into the POTW holding tanks after all tests have been completed so that the required grab sample can be obtained. One quart amber sample bottles with Teflon-lined lids will be directly filled from the sample tap, labelled and packaged for shipment to the analytical lab.

III.D.2.e. <u>Blanks</u>. A background water sample will be obtained from a water tap used to provide feed water to incinerator operations. A composite sample of the sandblasting sand used as the solid matrix will be obtained from several bags of sand selected at random. A sample of the alkaline solution (NaOH) used in the M5 sampling train will be provided to check for alkalinity. A sample of the acetone, methylene chloride and methanol used for MM5 and M5 rinsing will also be provided.

III.D.3. <u>Sampling Frequency and Schedule</u>.

The frequency of sample collection is summarized in Table III.D.2. Nominally, each run will require about 4 hours to perform, which is the time estimated to obtain two hours of continuous stack gas sample. The length of time required to perform stack testing dictates the length of each run. The length of time required for stack testing is based on the amount of stack gas that needs to be sampled so that a DRE of six nines can be obtained after taking into account the amount of POHC in the feedstock matrix and the detection limit of the analytical equipment to be used. Based on an anticipated minimum concentration of 1500 ppm of HCB and 1500 ppm of HCE in the feedstock matrix, the volume of stack gas that needs to be sampled is approximately 70 dry standard cubic feet which will require 2 hours of continuous stack sampling. Taking into account changing sampling locations and leak testing, this will require about 3 to 4 hours for each run.

Sample Description	Sample Type	Sampling Frequency	Number of Samples per Run
1. Feedstock matrix	Composite grab	About 9 grabs every 15 minutes (48 oz.)	5 - 16 ounce jars
2. Treated Solid Residue	Composite grab	About 9 grabs every 15 minutes (48 oz.)	5 - 16 ounce jars
3. Stack gas (MM5)	Modified Method 5	Nominal 2 hour duration for each run	
a. Particulate filter	solid		1 petri dish
b. XAD	solid		1 container
c. Probe wash	liquid		1 - one quart amber bottle
d. Condensate	liquid		1 - one quart amber bottle
e. Alkaline Trap	liquid		1 - one quart amber bottle
4. Stack Gas (M5) a. Probe Wash for particulate	EPA Method 5 liquid	Nominal 2 hour duration for each run	1 - one quart amber bottle
5. Effluent Neutralization Tank Background	Grab	Before any testing	8 - one quart amber bottles
6. Effluent Neutralization Tank Grab	Grab	After each run	4 - one quart amber bottles
7. Effluent Neutralization Tank Final Composite	Composite grab	Once at end of Trial Burn	16 - one quart amber bottles
8. Blanks			
a. Alkaline solution (NaOH)	Grab	Once before all tests	1 - 16 ounce jar
b. Acetone wash	Grab	Once before all tests	1 - 16 ounce jar
c. Solid matrix	Composite/grab	Once before all tests	5 - 16 ounce jars
d. Water	Grab	Once before all tests	8 - one quart amber bottles
e. Methylene chloride	Grab	Once before all tests	1 - 16 ounce jar
f. Methylene and	Grab	Once before all tests	1 - 16 ounce jar

Note: (1) Composite samples for the feedstock matrix and treated residue consist of grab samples taken every 15 minutes which are homogenized after completion of each run and split into sample aliquots. Every 15 minutes three jars are filled (3-16 ounce jars or 48 ounces) by taking about 9 individual scoops.

(2) Duplicate and spiked samples will be taken as is described in Section III.E of this trial burn report.

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Feedstock matrix samples will be collected from the conveyor before the matrix is transferred into the feed hopper. Samples will be obtained every 15 minutes beginning approximately 10 minutes prior to initiation of the run. Initiation of the run is when stack testing begins, which is coordinated with all other sampling activities. Sampling before the run actually begins accounts for the residence time of the soil in the hopper/screw feeder before it enters the kiln. Each 15 minute sample will require approximately 5 minutes for collection and will consist of a minimum of 9 individual grab samples taken at different locations on the conveyer for a total of 48 ounces of feedstock (i.e., 3 sixteen ounce jars will be filled). Feedstock matrix sampling will be performed for the duration of each test (nominally 4 hours).

Treated solid residue samples will be obtained every 15 minutes beginning 30 minutes after each run has begun (to take into account the residence time of the solid matrix in the kiln). Each 15 minute sample will require approximately 5 minutes for collection and consist of a minimum of 9 individual grab samples for a total of 48 ounces (i.e., 3 sixteen ounce jars will be filled). Sampling will be performed over the duration of each run and will be completed 30 minutes after the run has ended.

Grab samples of the effluent neutralization tank will be obtained at the completion of each run. The final effluent neutralization sample will be obtained after all six runs have been completed. All blank samples (including the effluent neutralization background sample), except stack gas blank samples, will be obtained prior to all testing.

III.D.4. Sample Containerization, Preservation, and Holding Times

All samples collected will be placed in containers and preserved (as required with ice) and will be analyzed within the time constraints consistent with procedures as summarized in EPA 600/4-79-020 Methods For Chemical Analysis of Water and Wastes (March 1983 Version) or as indicated in specific SW-846 Analytical Methods.

III.D.5. Sample Tracking and Management

All sample containers will be labelled with the upper portion of Versar's standard 3 part label. The duplicate label will be affixed to containers in which the sample jars are packaged. The lower portion of the sample label will be placed into the field log book as a cross check mechanism on sample identification. All samples will be tracked using Versar's standard chain of custody form. Custody of the samples will begin at the time of sample collection and will be maintained by the sampling team supervisor until samples are relinquished for shipment to the laboratory performing the final analysis.

III.D.6. Sample Shipment

All samples collected at the facility and shipped to the laboratory will be packaged and shipped in accordance with applicable DOT regulations. All shipments to the laboratory will be via Federal Express in order to meet time constraints.

III.E. Analytical Procedures

III.E.1. Analytical Methods

The analyses planned for each trial burn sample are listed in Table III.E.3.1, along with the analytical methods for both extraction and analysis. Special procedures or other considerations, related to the other analysis are discussed below. All of the analyses for organic compounds will be by capillary column GC/MS.

III.E.1.a. Hexachloroethane. Trichlorobenzene. Analysis for these compounds will be conducted by standard SW-846 methods, as specified Table III.E.3.1, and may be referred to in Section 9B of the Quality Assurance Project Plan.

TABLE III.E.3.1   ANALYSES PLANNED FOR NCBC TRIAL BURN

Test	Sample	Matrix	Type	Target(s)	Anal.	Extr.
BACKGROUND						
	Feedstock	Solid	Background	HCE, TCB	8270 GC/MS	3550 Sonication
	Ashdrag	Solid	Background	HCE, TCB	8270 GC/MS	3550 Sonication
	ENT	Liquid	Background	Archive	(1)	
	Potable	Liquid	Background	Arc.ive	(1)	
	Sand	Solid	Background	Archive	(1)	
	Acetone Wash	Liquid	Background	Archive	(1)	
	Caustic	Liquid	Background	Archive	(1)	
RUN 7-A						
	Feedstock	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT	Liquid	Grab	Archive	(1)	
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic	HCl	EPA Method 325.3	
RUN 7-B						
	Feedstock	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT	Liquid	Grab	Archive	(1)	
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic	HCl	EPA Method 325.3	
RUN 7-C						
	Feedstock	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT	Liquid	Grab	Archive	(1)	
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic	HCl	EPA Method 325.3	

(1) - Analyzed only if contamination is suspected.

TABLE III.E.3.1   ANALYSES PLANNED FOR NCBC TRIAL BURN

Test	Sample	Matrix	Type	Target(s)	Anal.	Extr.
RUN 8-A						
	Feedstock	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT	Liquid	Grab	Archive	(1)	
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic	HCl	EPA Method 325.3	
RUN 8-B						
	Feedstock	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT	Liquid	Grab	Archive	(1)	
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic	HCl	EPA Method 325.3	
RUN 8-C						
	Feedstock	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT (2)	Liquid	Grab	Archive	(1)	
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic		EPA Method 325.3	
POST-TEST						
	ENT FINES (3)	Solid	Grab	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication

(1) · Analyzed only if contamination is suspected.
(2) · BOD, COD as per MS Effluent Permit.
(3) · Analyzed only if Scrubber Fines are present.

III.E.2. Sample Recovery Procedures

The laboratory sample custodians will inspect the samples as received and accept custody. Sample aliquots will be taken for the required analyses. Surrogate and/or reference compounds will be added to each aliquot in accordance with the requirements of the qualytical protocols. The specific compounds and the amounts to be added will be as called for in the analytical procedures. The laboratory will be responsible for implementing its own instrument calibration and QA/QC procedures.

The procedures for recovering compounds from the major sample groups are briefly summarized below.

III.E.2.a. Organic Liquids. The MM5 probe rinse will be dried according to EPA Method 5 procedures, except that drying time will be limited to less than 4 hours. The rinse residue will be dissolved in tne metylene chloride and concentrated by evaporation. The concentrated extract will be combined with sorbent resin extract.

III.E.2.b. Solids. This group includes solid waste feeds (soils), kiln ash, and MM5 particulate filters.

A weighed aliquot of the sample will be extracted using the method specified solvent and concentrated by evaporation. Extract cleanup will follow as required by the analytical procedures identified in the next section.

The MM5 particulate filter will be Soxhlet extracted using methylene chloride, then concentrated by evaporation.

III.E.2.c. Aqueous. This sample group includes makeup water, purge water, caustic neutralizing solution, MM5 condenser water, and the MM5 impinger water. A 1-liter aliquot of each sample (except the impinger water) will be subjected to triple liquid-liquid extractions with methylene chloride in a separatory funnel as described in EPA Method 3510.

III.E.2.d. Sorbent Resins. The MM5 sorbent traps will be Soxhlet extracted with methylene chloride, then concentrated by evaporation. The extracts from the components of the MM5 train (XAD resin, filter, probe rinse, and aqueous liquids) will be combined and concentrated by evaporation.

III.F. Operational Monitoring Procedures

Operational monitoring for all MWP-2000 operations is continually conducted by the Data Acquisition and Control Computer (DAS) located in the control room trailer. The DAS continually displays all plant operating parameters. Those parameters are also recorded on a hard disk and printed at least every 10 minutes. The specific parameters required during the trial burn are shown in Table III.G.1, which is found in the Detailed Trial Burn Protocol, Section III.G. Additional details of the plant monitoring can be found in Section II.

III.G. Detailed Trial Burn Protocol

III.G.1. Basic Objectives

The trial burn will consist of two sets of triplicate tests. The first set will be conducted at a nominal feed rate of 4.0 ton/h and the second set will be conducted at a nominal feed rate of 5.0 ton/h.

The objective of the two tests is to show that the MWP-2000 can achieve a 99.9999% Destruction and Removal Efficiency (DRE) on Appendix XIII listed constituents which have a heat of combustion greater than 0.46 kcal/gram. The purpose of the first test is to establish a nominal feed rate for which a 99.9999% DRE is clearly demonstrable. The purpose of the second set of tests is to establish an upper bound on the mass feed rate for which a 99.9999% DRE may be achievable. If the higher feed rate tests are successful, permission will be sought to operate the incinerator at the higher feed rate on NCBC native soil that is contaminated with various constituents of Herbicide Orange (HO).

The two sets of trial burn tests will be designated as Test 7 and Test 8 in order to avoid confusion with the first six tests conducted as part of the Verification Test burns conducted in December, 1986.

III.G.2. Test Operating Conditions

Table III-G-1 lists the conditions and parameters that will be monitored during the trial burns. The specified conditions are only recommended set points unless the parameter is indicated by an asterisk (*). Such noted parameters are specified in the RD&D Permit and therefore compliance is mandatory. This list is intended to represent the minimum parameters to be monitored, additional parameters may be monitored as deemed necessary by the operations manager.

III.G.3. Waste Feed

The waste feed for these tests will be a graded, washed material such as sandblasting sand mixed with Hexachloroethane (HCE) and Trichlorobenzene (TCB) as POHCs. The concentration of HCE and TCB will be at least 1500 ppm. Details of the POHC selection are found in Section III.A.

Approximately 36 tons of clean sand will be used for the clean soil shakedown test and approximately 220 tons of surrogate spiked sand will be processed during the trial burn tests.

The POHCs will be batch mixed with the sand in a cement mixer. For each 9 cubic yard batch, at least 50 pounds of each POHC will be placed into the sand mixture in 4 discrete portions. This formulation will give a POHC concentration of 1500 to 3000 ppm for each of the two POHCs. Between each portion, the mixer will be operated for approximately 10 minutes. After the final portion is added, the mixer will be operated for an additional hour to ensure a homogeneous mixture of sand and surrogate. Approximately 25 batches of sand will be prepared.

TABLE III-G-1. OPERATING CONDITIONS AND MONITORED PARAMETERS

Parameter	Normal Set Point
Nominal Soil Feed Rate	Test 7: 4.0 ton/h, Test 8: 5.0 ton/h
Soil Residence Time	Variable 20 - 60 min
Kiln Combustion Air Flow Rate	120 lbs/min
Kiln Outlet Gas Temperature[a]	1350 - 1800°F
Kiln Pressure[a]	negative pressure
SCC Combustion Air Flow Rate	300 lbs/min
SCC Outlet Gas Temperature[a]	2100°F minimum
SCC Pressure	negative
Gas Residence Time in SCC[a]	1.0 - 2 seconds
Combustion Efficiency[a]	99%
Boiler Outlet Gas Temp	450°F
Boiler Steam Pressure	220 - 240 psig
Steam Drum Level	30 - 60%
Boiler Makeup Water Flow Rate	20 - 30 gpm
Quencher Recirulation Water Flow Rate	100 gpm
Quencher Makeup Water Flow Rate	15 gpm
Quencher Outlet Gas Temperature	190°F
Packed Tower Recirculation Water Flow[a]	approximately 170 gpm or as necessary to achieve required scrubber efficiency
Packed Tower Makeup Water Flow Rate	15 gpm

TABLE III-G-1. (continued)

Parameter	Normal Set Point
Scrubber Recirculation Water Flow Rate[a]	approximately 40 gpm or as necessary to achieve required scrubber efficiency
Stack Gas Oxygen[a]	3% min.
Stack Gas CO_2	function of combustion efficiency
HCl emissions	1.8 kg/h or 1% of HCl concentration into the scrubber, which ever is greater
Particulate matter	180 mg/dscm corrected for O_2

a. Indicates parameter is a specified permit condition.

POHC addition will be accomplished with the highest degree of accurancy possible, and will be thoroughly documented for comparison with feedstock analytical results. Both homogeneity and bulk concentration will be considered throughout the POHC addition procedures.

The mixture will then either be stored in temporary units or plastic lined staging piles or placed directly into the weigh hopper for processing. The sand mixture will be protected from rain.

After the mixture is placed into the weigh hopper for processing, it will be sampled to determine its exact concentration for the trial burns. Additional details on feed stock sampling are found in Section III.D

III.G.4. Fuel

The kiln and Secondary Combustor will be fired on natural gas for all tests. The kiln will be fired at approximately 14 MBtu/h and the Secondary Combustor will be fired at approximately 24 MBtu/h.

III.G.5. Scrubber Water

III.G.5.a. Before Trial Burns. The following pieces of equipment will be thoroughly rinsed prior to incinerator warmup.

o   Effluent Neutralization Tank (ENT)

o   Scrubber Sump

o   Packed Tower

o   Ash Drag Sump

The water from the rinsing effort will be discharged to the POTW effluent storage tank via the carbon filter beds. Samples will be obtained from that tank and analyzed for 2,3,7,8-TCDD, 2,4,5-T and 2,4-D. If the concentrations of those compounds are nondetectable then the water will be

discharged to the Publicly Owned Treatment Works. The purpose of this effort is to minimize the potential for cross contamination of water used during the Verification Test Burns conducted in December, 1986. Those tests were performed on native NCBC soils that were contaminated with the aforementioned compounds. This task is in compliance with the POTW permit issued by the Mississippi Department of Natural Resources.

III.G.5.b. After Trial Burns. After each test, a sample of the ENT water will be obtained and archived. Following Test 8, the ENT water will be discharged to the POTW effluent storage tank via the dual carbon filter beds. The water will then be sampled for HCE and TCB. If the water is found to be free of those compounds, then the water will be discharged to the POTW. If the water in the POTW holding tanks is found to contain detectable quantities of HCE or TCB, then provisions will be made to properly treat or dispose of the waste water.

Additional information on sampling of the POTW effluent water can be found in Section III-D-1.

III.G.5. Test Duration

A two hour stack gas sample is desired in order to obtain a sufficiently representative sample. Therefore, the actual duration of the test is expected to last approximately 3 hours.

Depending upon weather conditions and unforeseen malfunctions, the six stack tests will be obtained over a six to ten day window.

III.G.7. Sequence of Events

III.G.7.a. Preliminary Steps. The following items describe the preliminary events which must be completed prior to formal trial burn testing.

o   Clean and flush the scrubber system as described in
      Section III-G-5.2.

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o   Mix the POHC with the sand.

o   Check out the incinerator system including all instrument
    interlocks, instrument calibrations, pumps, and motors. If
    possible, this check out should be conducted prior to warming up
    the system.

o   Fire-up the kiln and SCC and begin warming the system using the
    standard operating conditions.

o   Stabilize at the operating conditions specified in Table III-G-1
    for 12 hours using only natural gas; no waste or surrogate shall
    be fed to the incinerator during this time.

o   Begin processing clean, non-surrogate spiked sand at a feed rate
    of 4.0 tons/hour for 4 hours. Gradually increase the feed rate
    to 5.0 tons/h and maintain that feed rate for an additional 4
    hours. The purpose of this step is to check out the soil feed
    system prior to the formal trial burns.

o   Discontinue sand feed to the incinerator and bring the system to
    a warm standby until the formal trial burns are ready to
    commence. If, however, the time is near dawn, then the formal
    ʼ~ial burns may commence. The procedures for formal trial burn
    testing are given in Section 7.2 below.

III.G.7.b. Formal Trial Burn Tests

    NOTE: The following steps will constitute the trial burn test
           and should be conducted only with the concurrence of the
           Air Force Project Officer, the EG&G Program manager (prime
           contractor), the Versar manager (sampling subcontractor),
           and the ENSCO Program manager (incinerator
           subcontractor). This approval is necessary to ensure that
           all personnel and equipment are ready to commence the test.

Listed below is a general time sequence of events for each day of testing.

Approximate Time	Action
01:00	Complete warmup so that the unit is at full operating conditions as specified in Table III-G-1.
02:00	Begin feeding clean non-surrogate spiked sand to the incinerator at a feed rate of 4.0 ton/h for Test 7 and 5.0 ton/h for Test 8. Continue to feed the clean sand to the incinerator f~~ 4 hours.
NOTE:	This step does not have to be duplicated if similar action was taken as described in Section 7.1
06:00	Check to ensure that the unit has reached full equilibrium conditions. The kiln and Secondary temperature should be steady to within +/- 50°F for at least 2.5 hours. If the kiln and SCC temperatures have reached thermal equilibrium on clean sand, begin feeding surrogate spiked sand to the incinerator at a feed rate of 4.0 ton/h for Test, and 5 tons/h for Test 8. Continue to feed the spiked sand to the incinerator for approximately 1.5 hours to reach equilibrium on spiked sand. Continue to monitor kiln and SCC temperatures to ensure that thermal equilibrium is maintained.
09:00	Upon concurrence of the sampling subcontract manager and the incinerator operations manager, the sampling crew will be directed to begin sampling according to the established protocol in Section III-D.
12:00	The stack test will take approximately three hours to complete. Upon completion of the stack test, the sampling crew will begin clean-up operations.
12:20	Approximately twenty minutes after the gas sample is completed, the stack sampling crew will direct the incinerator operations crew to discontinue feeding of waste to the incinerator. Incinerator feeding for the extra twenty minutes is necessary in order to obtain complete and accurate waste feed rate information.

III.H. Procedures During Equipment Malfunction

During major equipment malfunction, the incinerator's Automatic Waste
Feed Shut Off control is automatically invoked by the data acquisition and
control computer which is programmed to automatically cut off solid waste
feed through the auger feed when any of the following conditions occurs:

1. Combustion efficiency, as measured by:

$$\frac{(CO_2)}{(CO_2 + CO)} \times 100$$

falls below 99, where CO and CO_2, respectively, are the carbon
monoxide and carbon dioxide concentrations in the stack gases.

2. Oxygen concentration in the stack gases falls below 3%.

3. Secondary combustor outlet gas temperature falls below 2100°F.

These same conditions cause a simultaneous automatic wastefeed cutoff
to the secondary combustor. (Note: The wastewater and sludge injection
nozzles will not be used in this demonstration project. The waste oil
injection nozzles will be used only to dispose of waste kerosene oil used
during final cleanup operations.)

Stack gas analyzers in the control room trailer continuously supply
measurements of the concentrations of oxygen, carbon monoxide, and carbon
dioxide in the stack gases. These measurements are transmitted to the data
acquisition and control computer, which uses them to monitor conditions 1
and 2 above, and effect automatic waste feed switching and shutoff. The
thermocouple in the combustor outlet duct provides the computer with data
to monitor condition 3 and effect automatic cutoff procedures.

The flame supervisor serving the kiln shuts off all fuel and waste
flows to the kiln if there is a loss of flame in the kiln.

The flame supervisor serving the secondary combustor cuts off all fuel and waste feed to the the kiln if there is a loss of flame in the combustor. Simultaneously, this supervisor shuts off all fuel and waste feeds to the combustor.

The low-low liquid level switch on the steam drum shuts off all fuel and waste feeds to the kiln and secondary combustor if the water level in the drum falls below 25%.

The aforementioned potential malfunctions are the most significant and therefore, automatic Factory Mutual type interlocks are installed on the burner. Other equipment malfunctions will be solved on a case by case basis.

III.I. System Inspection

Table III-I-1 shows the inspection and maintenance schedules for the MWP-2000 incinerator system. This table was extracted from the RD&D permit application and has been updated to reflect the as-built needs of t e incinerator system at the NCBC site. This inspection schedule is currently in effect. A member of the operations crew is assigned the task of routine inspection.

Spill inspection will follow the SPCC plan, outlined in Appendix III-I. That plan has been updated to include the changes necessitated by the processing of HCE and TCB.

The health and safety officer and the operation manager inspect the site daily for evidence of spill, leaks, and other potential health and safety problems.

III.J. Record Keeping

The control room operators keep detailed operational logs on all aspects of the MWP-2000 operation. Those logs include such items as valve position changes, motor switching, movement of ash bins and feed system

TABLE III.I.1. EQUIPMENT/INSTRUMENT LIST

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Rotary Kiln		
Waste feed to burner, lb/min	1	Continual
Clean fuel feed, lb/min	1	Continual
Sludge feed, lb/min	1	Continual
Wastewater feed, lb/min	1	Continual
Combustion air feed, lb/min	1	Continual
Vacuum, in. water	1	Continual
Outlet gas temperature, °F	1	Continual
Liquid waste and fuel feed lines	2	Inspect for leaks. Repair if found.
Pump and strainer on operating waste fuel feed line	2	Switch feed to alternate pump. Remove and clean strainer.
Pump on operating clean fuel feed line	2	Switch feed to alternate pump.
Pump and strainer on operating wastewater feed line	2	Switch feed to alternate pump. Remove and clean strainer.
Combustion air and supplemental air blowers	2	Check for overheated bearings and vibrations. Repair if found.
Solid waste feed conveyor and ram or screw feed	2	Inspect for visual signs of malfunction. Repair if found.
Sight glass into kiln and TV camera lens	2	Clean.
Hydraulic drive for ram or screw feed	3	Inspect hydraulic fluid level. Fill if necessary. Inspect hoses for leaks.

a. Key for frequency column: 1 = continual computer monitoring; 2 = daily; 3 = weekly; 4 = monthly; 5 = full shutdown.

TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/Calibration Frequency[a]	Inspection/Maintenance
Hydraulic drive for kiln	3	Inspect hydraulic fluid level. Fill if necessary. Inspect hoses for leaks.
Hydraulic drive for treated soil removal chain	3	Inspect hydraulic fluid level. Fill if necessary. Inspect hoses for leaks.
Feed pumps on waste fuel, clean fuel, wastewater and sludge feed lines	3	Inspect oil level. Fill if necessary.
Strainer on operating clean fuel feed line	3	Remove and clean.
Combustion air and supplemental air blowers	3	Lubricate.
Flame detector	5	Clean flame detector lens.
Propane tank serving burner pilot	3	Check tank pressure. Fill if necessary.
Burner	3	Visually inspect externally for signs of leaks, wear, overheating or damage.
Ram or screw feed	3	Inspect nuts. Tighten if loose.
Combustion air and supplemental air blowers	4	Inspect suction filters and replace cartridges if necessary.
Roller bearings	4	Lubricate.
Solid waste feed conveyor	5	Lubricate roller bearings.
Refractory	5	Inspect for loose brick, spalling, cracking, or other damage. Repair if necessary.
Burner	5	Remove and clean nozzle and inspect for wear or damage. Repair if necessary.

TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Cyclones	5	Inspect refactory for damage. Repair if found.
Treated soil removal system	5	Inspect chain drag for excessive wear. Replace if found.
Mass flow meters on fuel, wastewater and sludge feed lines	5	Calibrate.
Combustion air and supplemental air blowers	5	Inspect vanes for damage or excessive wear. Repair if found.
Secondary Combustor		
Waste feed to burner, lb/min	1	Continual
Clean fuel feed, lb/min	1	Continual
Wastewater feed, lb/min	1	Continual
Combustion air feed, lb/min	1	Continual
Pressure drop, in. water	1	Continual
Outlet gas temperature, °F	1	Continual
Oxygen, (%)	1	Continual
Carbon monoxide, ppm	1	Continual
Liquid waste and fuel feed lines	2	Inspect for leaks. Repair if found.
Pump and strainer on operating waste fuel feed line	2	Switch feed to alternate pump. Remove and clean strainer.
Pump on operating clean fuel feed line	2	Switch feed to alternate pump.
Pump and strainer on operating wastewater feed line	2	Switch feed to alternate pump. Remove and clean strainer.

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TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Combustion air blower	2	Check for overheated bearings and vibrations. Repair if found.
Burner	2	Rod center tube of nozzle.
Sight glass into combustor and TV lens	2	Clean.
Oxygen and CO monitors	2	Calibrate (zero and span). Check flow rate and correct if necessary. Inspect desiccator. Replace desiccant if necessary.
Feed pumps on waste fuel, clean fuel and wastewater feed lines	3	Inspect oil level. Fill if necessary.
Strainer on operating clean fuel feed line	3	Remove and clean.
Flame Detector	5	Clean flame dtector lens.
Combustion air blower	3	Lubricate.
Propane tank serving burner pilot	4	Check tank pressure. Fill if necessary.
Oxygen and CO monitors	4	Calibrate (four points on scale).
Burner	4	Visually inspect externally for signs of leaks, wear, overheating or damage.
Combustion air blower	4	Inspect suction filter and replace cartridge if necessary.
Combustor	5	Clean out accumulated solids.
Refractory	5	Inspect for loose brick, spalling, cracking, or other damage. Repair if found.

TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Burner	5	Remove and clean nozzle and inspect for wear or damage. Repair if found.
Mass flow meters on waste fuel, clean fuel and wastewater feed lines	5	Calibrate.
Oxygen monitor	5	Check fuel cell. Replace if required.
CO monitor	5	Clean sample cell.
Combustion air blower	5	Inspect vanes for damage or excessive wear. Repair if found.
Waste Heat Boiler		
Outlet gas temperature, °F	1	Continual
Steam drum water level, %	1	Continual
Make-up water flow, gpm	1	Continual
Pressure drop, in. water	1	Continual
Steam temperature, °F	1	Continual
Steam pressure, psig	1	Continual
Steam flow, lb/min	1	Continual
Boiler feed pumps	3	Inspect oil level. Fill if necessary.
Strainers	3	Remove and clean.
Boiler	5	Inspect boiler tubes and end plates for solids buildup and corrosion. Clean and repair if necessary.
Boiler feed pumps	5	Lubricate bearings.

TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/Calibration Frequency[a]	Inspection/Maintenance
Quench System and Packed Tower		
Pressure drop, in. water	1	Continual
Recirculation flow, gpm	1	Continual
Flow from packed tower, gpm	1	Continual
Effluent flow, gpm	1	Continual
Inlet gas temperature, °F	1	Continual
Recirculation flow, gpm	1	Continual
Flow from scrubber, gpm	1	Continual
Flow to quench system, gpm	1	Continual
Entire system and associated piping.	2	Inspect for leaks. Repair if found.
Quench recirculation pumps	3	Inspect oil level. Fill if necessary.
Packed tower recirculation pumps	3	Inspect oil level. Fill if necessary.
Strainer on packed tower recirculation line	3	Remove and clean.
Mass flow meters on quench recirculation line, packed tower recirculation line, line from packed tower to quench elbow, line from scrubber sump to packed tower water makeup line	5	Calibrate.
Quench sump	5	Clean if necessary. Inspect for heat damage.
Ductwork	5	Inspect for solids buildup, corrosion, and heat damage. Clean and/or repair as necessary.

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TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Quench elbow	5	Clean and inspect nozzles.
Solids separators	5	Clean and inspect for operability. Repair as necessary.
Ejector Scrubber and Stack		
Inlet gas temperature, °F	1	Continual
Outlet scrubber gas, °F temperature	1	Continual
Pressure drop in. water	1	Continual
Inlet steam pressure, psig	1	Continual
Recirculation flow, gpm	1	Continual
Makeup water flow, gpm	1	Continual
Outlet stack gas, °F temperature	1	Continual
Oxygen, %	1	Continuous
Carbon dioxide, %	1	Continuous
Carbon monoxide, ppm	1	Continuous
Combustion efficiency, %	1	Continual
Entire system and associated piping	2	Inspect for leaks. Repair if found.
pH meter in scrubber sump	2	Calibrate.
Recirculation pumps	3	Inspect oil level. Fill if necessary.
Caustic feed pumps	3	Inspect oil level. Fill if necessary.

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TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Strainer on recirculation line	3	Remove and clean.
Mass flow meters on recirculation, caustic feed and makeup water line	5	Calibrate.
Scrubber sump	5	Clean if necessary.
Solids separators	5	Clean and inspect for operability. Repair as necessary.
Stack Sampling Equipment		
Water trap and filter	2	Drain water from trap. Clean filter if required. Inspect desiccant and replace if necessary.
Air line and sample line	2	Check adequacy of air flow to drier. Correct if necessary. Check flow rate in sample line. Adjust if necessary.
Oxygen, CO, CO_2,	2	Calibrate (zero and span).
pH and conductivity meters	2	Calibrate.
Pump	3	Inspect pump flow output. Replace pump hear if necessary.
Oxygen, CO, CO_2, NO_x, hydrocarbon analyzers	3	Calibrate (four points on scale).
CO and CO_2 analyzers	4	Clean sample cell.
Oxygen analyzer	4	Check fuel cell. Replace if required.
Monitoring system	5	Drain and clean or replace tubing.

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TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Neutralization and Concentration Unit		
Entire unit and associated piping	2	Inspect of leaks. Repair if found.
Concentrator recirculation pump	2	Check to ensure steam flow to pump casing.
Transfer pumps from neutralizer to concentrator	3	Inspect oil level. Fill if necessary.
Concentrator recirculation pumps	3	Inspect oil level. Fill if necessary.
Lime feeder	4	Lubricate bearings.
Neutralization tank	4	Drain nd clean.
Boiler Water Makeup Treatment Unit		
Entire unit and associated piping	2	Inspect for leaks or spills. Repair if found.
Boiler feed pumps	2	Alternate operation.
Tanks	2	Check adequacy of water/reagent in tanks. Correct if necessary.
Raw water transfer pumps	3	Inspect oil level. Fill if necessary.
Treated water transfer pumps	3	Inspect oil level. Fill if necessary.
Sulfite and caustic solution transfer pumps (if installed)	3	Inspect oil level. Fill if necessary.
Strainers on raw water line, treated water line, salt solution feed line and boiler feed line	3	Remove and clean.
Saltwater solution tank	4	Empty, clean and refill.

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TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/Calibration Frequency[a]	Inspection/Maintenance
Strainer on recirculation line	3	Remove and clean.
Mass flow meters on recirculation, caustic feed and makeup water line	5	Calibrate.
Scrubber sump	5	Clean if necessary.
Solids separators	5	Clean and inspect for operability. Repair as necessary.

Stack Sampling Equipment

Equipment/Instrument	Inspection/Calibration Frequency[a]	Inspection/Maintenance
Water trap and filter	2	Drain water from trap. Clean filter if required. Inspect desiccant and replace if necessary.
Air line and sample line	2	Check adequacy of air flow to drier. Correct if necessary.
		Check flow rate in sample line. Adjust if necessary.
Oxygen, CO, CO$_2$,	2	Calibrate (zero and span).
pH and conductivity meters	2	Calibrate.
Pump	3	Inspect pump flow output. Replace pump hear if necessary.
Oxygen, CO, CO$_2$, NO$_x$, hydrocarbon analyzers	3	Calibrate (four points on scale).
CO and CO$_2$ analyzers	4	Clean sample cell.
Oxygen analyzer	4	Check fuel cell. Replace if required.
Monitoring system	5	Drain and clean or replace tubing.

TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Neutralization and Concentration Unit		
Entire unit and associated piping	2	Inspect of leaks. Repair if found.
Concentrator recirculation pump	2	Check to ensure steam flow to pump casing.
Transfer pumps from neutralizer to concentrator	3	Inspect oil level. Fill if necessary.
Concentrator recirculation pumps	3	Inspect oil level. Fill if necessary.
Lime feeder	4	Lubricate bearings.
Neutralization tank	4	Drain nd clean.
Boiler Water Makeup Treatment Unit		
Entire unit and associated piping	2	Inspect for leaks or spills. Repair if found.
Boiler feed pumps	2	Alternate operation.
Tanks	2	Check adequacy of water/reagent in tanks. Correct if necessary.
Raw water transfer pumps	3	Inspect oil level. Fill if necessary.
Treated water transfer pumps	3	Inspect oil level. Fill if necessary.
Sulfite and caustic solution transfer pumps (if installed)	3	Inspect oil level. Fill if necessary.
Strainers on raw water line, treated water line, salt solution feed line and boiler feed line	3	Remove and clean.
Saltwater solution tank	4	Empty, clean and refill.

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TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/Calibration Frecuency[a]	Inspection/Maintenance
Mass flow meters on treated water line, de-aerator inflow line and boiler makeup water feed line	5	Calibrate.
Air Supply System		
Compressor	2	Check for unusual noise or vibration. Repair if found.
		Inspect oil level. Fill if required.
Air tank	2	Drain condensate.
Regulators on instrument lines	2	Drain condensate.
Compressor	3	Clean air inlet filter.
Air tank	3	Inspect operability of pressure relief valve.
Compressor	4	Clean after-cooler tubes and cooler fins.
Desiccators	4	Inspect desiccant. Fill or replace as necessary.
Compressor	5	Change oil.
Emergency Generator		
Generator	2	Start to ensure operational readiness. Repair if necessary.
Bulk Liquids Staging Unit		
Tanks and piping	2	Inspect for leaks. Repair if found.
Containment system	2	Inspect for standing water or liquids. Remove if found.

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TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/ Calibration Frequency[a]	Inspection/Maintenance
Unloading and recirculation/ transfer pumps	3	Inspect oil level. Fill if necessary.
Strainers on unloading and recirculation/transfer lines	3	Remove and clean.
Bulk Solids Staging Unit		
Wastes staged	2	Inspect for improper segregations of batches and signs of wind or water erosion of wastes. Correct if found.
Loose solids Staging Unit		
Wastes staged	2	Inspect for improper segregation of batches and leaking containers or items. Correct if found.
Containment System	2	Inspect for standing water or liquids. Remove if found.
Solids Processing Units		
Fugitive emission control equipment and procedures	2	Inspect for malfunction or improper implementation. Correct if found.
Containment system	2	Inspect for standing water or liquids. Remove if found.
Pumps	3	Inspect oil level. Fill if necessary.
Hydraulic drives	3	Inspect hydraulic fluid levels. Fill if necessary. Inspect hoses for leaks. Repair if found.
Motors and equipment bearings	4	Lubricate.
Treated Soil Staging Unit		
Roll-off boxes and drums	2	Inspect for being covered. Correct if not covered.

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TABLE III.I.1. (continued)

Equipment/Instrument	Inspection/Calibration Frequency[a]	Inspection/Maintenance
Effluent Staging Unit		
Tanks and piping	2	Inspect for leaks and spills. Repair if found.
Containment system	2	Inspect for standing water or liquids. Remove if found.

a. Key for frequency column: 1 = continual computer monitoring;
2 = daily; 3 = weekly; 4 = monthly; 5 = full shutdown.

operation. The operators also record any abnormal maintenance during operations. The operation logs are kept in a bound and page numbered logbook located inside the control room.

Maintenance records are also kept separately for each piece of equipment in order to track the need for additional routine maintenance or part replacement.

The Data Acquisition and Control Computer continuously records all process instrumentation and stores that information to hard disk storage every ten minutes. A hard copy is also printed every ten minutes.

Health and safety records and personnel training records are also kept onsite by the Ensco Health and Safety Officer.

III.K. Site Cleanup

Following the trial burns, the site will be cleaned by careful decontamination of all rented equipment used. Specifically, the cement mixer will be thoroughly cleaned by performing the following steps:

o   Empty all surrogate spiked sand from the mixer and place it into the incinerator weigh hopper.

o   Place clean sand into the mixer and rotate the mixer for approximately 30 minutes to scour the inside of the mixing bin.

o   Empty the clean sand and then steam clean the inside of the mixer.

o   Swipe sample the inside of the mixer and send the samples to the analytical laboratory for analysis of HCE and TCB. If the samples come back as clean, then the mixer can be returned to the vendor.

Any sand mixture left over after the trial burns will be processed in the incinerator. The clean sand and processed sand will be used for fill following the completion of the project.

The incinerator system will be cleaned at the termination of the project.

III.K. Quality Assurance Project Plan

The Quality Assurance Project Plan for this trial burn is contained in Appendix I. It presents, in specific terms, the policies, organization, objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities which will be used to achieve data quality for sampling and analysis.

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APPENDIX FOR SECTION III-I
SYSTEM INSPECTION

SPILL PREVENTION, CONTROL, AND COUNTERMEASURES PLAN
FOR THE
AIR FORCE INCINERATION PROJECT

NCBC, GULFPORT, MS

NOVEMBER 3, 1986

AMENDED: NOVEMBER 20, 1986
          MARCH 17, 1987

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SPILL PREVENTION, CONTROL, AND COUNTERMEASURES PLAN
FOR THE
AIR FORCE INCINERATION PROJECT

NCBC, GULFPORT, MS

NOVEMBER 3, 1986

AMENDED: NOVEMBER 20, 1986
           MARCH 17, 1987

Note: This document was amended on November 20, 1986 to reflect changes in
       safety personnel and changes in the plan mandated by construction
       restraints. The changes are highlighted by a double asterisk (**)
       at the beginning and end of the change.

       The second amendments were made on March 17, 1987 to reflect changes
       mandated by the RCRA trial burn plan. Those amendments are
       designated by a double dollar sign, i.e., "$$".

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1.0 INTRODUCTION

Beginning in September, 1986, the Unites States Air Force in cooperation with EG&G Idaho and ENSCO Environmental Services will conduct a research and development demonstration project at a former Herbicide Orange (HO) storage site located at the Naval Construction Battalion Center, Gulfport, MS. The goal of the project is to obtain reliability and maintainability data on the MWP-2000 mobile incinerator which is manufactured and operated by ENSCO Environmental Services. The system is a rotary kiln incinerator which will be used to process cement stabilized soil that is contaminated with 2,3,7,8 TCDD.

The purpose of this document is to describe the methods and equipment which will be used to control potential spills which may contain hazardous substances.

General information pertaining to this Spill Prevention Control and Countermeasures (SPCC) plan is listed below.

Facility Name:	Former Herbicide Orange Storage Site NCBC Gulfport, MS
Type of Equipment:	Two stage rotary kiln incinerator for hazardous waste incineration
Permittees:	United States Air Force United States Navy
**SPCC Officer	Steve Saunders, Ensco Environmental Services**
Previous spillage of hazardous substances	None, however substantial quantities of herbicide orange were spilled during previous operations in the 1960s and 1970s. (This spillage is the impetus for the hazardous waste incineration research activities on this site.) This incineration activity has had no spillage of any hazardous substance.

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2.0 SITE DESCRIPTION AND NATURAL SPILL CONTAINMENT

The MWP-2000 incinerator is located on the former Herbicide Orange storage site. That site is bounded on three sides by railroad tracks and an 18 in. high soil berm on the far east end of the site. **This area is referred to as the SPCC control area.** Sediment filters have been constructed on all drainage ditches. These barriers act as the final spill containment barriers in the event of a large volume spill within the former HO storage site.

Additional barriers and spill protection measures have been taken in the areas containing hazardous substances. The hazardous substances, their spill potential, and the spill protection techniques are described below.

3.0 HAZARDOUS SUBSTANCE INVENTORY AND SPILL POTENTIAL

3.1 Mercury (Hg)

Approximately one pint of mercury is stored in the instrument calibration trailer on the former HO storage site. It is used for instrument calibration. The spill potential is minimal because the mercury is contained in a sealed glass bottle inside of the control room trailer.

3.2 Quench Tank

The quench tank is located adjacent to the Secondary Combustion Chamber (SCC) of the incinerator. It receives cooling water from the quench elbow. The tank volume is approximately 5000 gallons.

Because the quench elbow receives process off gas from the SCC, the quench tank would only contain a hazardous substance, such as 2,3,7,8-TCDD, 2,4-D, or 2,4,5-T, if the incinerator process failed, i.e., if either the temperature or residence time of the SCC were below their prescribed limits, which would cause incomplete combustion of the incinerator off gases.

A hazardous spill from the effluent tank would only occur if the incinerator process failed __and__ if a leak developed in the effluent tank. It is unlikely that the tank would develop a leak because it is fabricated of 1/4 in. carbon steel with welded seams and bolted flanges and is not exposed to a high temperature atmosphere. Therefore, the spill potential for this tank is considered very low.

If in the unlikely event of a spill from the quench tank, the contaminated solids would be contained within the SPCC control area. Absorbent clay and sand are readily available on site to prevent spillage from spreading. The clay is located in the safety storage trailer and the sand is located in the clean spoils area. A front end loader is available to move the spill control materials to any spill on site.

3.3 Scrubber Effluent Tank

Two 12,000 gallon tanks are located outside of the incinerator area and within a diked area that is lined with three layers of 10 mill polyethylene plastic. The diked area is also stabilized with a layer of geotextile material. The purpose of those tanks is is to receive the effluent water from the air pollution control scrubber **after the water has been filtered through activated charcoal bed.** Similar to the quench tank, the effluent tanks could only contain trace quantities of TCDD, 2,4,D, or 2,4,5-T if the incinerator process failed $$ and if the activated carbon filters were loaded to their capacity.$$

The water contained in the effluent tanks will be collected and analyzed for 2,4-D or 2,4,5-T. If the analysis shows the water to be clean, then it will be discharged to the Publicly Owned Treatment Works (POTW) sewer. If the water is contaminated, then it will be processed in the incinerator. A POTW permit has been obtained from the Mississippi State Department of Natural Resources.

The tanks are fabricated of 9/16 in. carbon steel with bolted flanges. The tanks are not in a high temperature or high pressure atmosphere, and therefore, the potential for a spill from those tanks is considered low.

In the unlikely event of a spill from the scrubber effluent tank, the liquid would be contained within the bermed area which is sized to contain approximately 13,500 gallons. Because only one tank will be used at any given time, 13,500 gallons is sufficient to contain the contents of one effluent tank.

3.4 FUEL STORAGE AREA

Two fuel storage tanks are located outside of the former HO storage site. These tanks are 250 gallons each; one tank contains diesel fuel and the other tank contains gasoline. The tanks are inside a bermed area than can contain 450 gallons. The bermed are a is lined with an SPCC-sorbant blanket.

Due to the nature of fueling operations, a small spill is possible, however it would be contained within the bermed storage area. Furthermore, the SPCC-sorbant blanket would absorb any spilled fuel. Rainwater will be drained from the bermed area as needed.

**

3.5 ACIDS AND CAUSTICS

Potassium Hydroxide is used for boiler feedwater pH and oxygen control. Approximately four 55 gallon barrels are stored in the incinerator area in a lined and bermed area. The berm is made of untreated railroad ties, and the liner is two layers of 10 mil polyethylene plastic.

Acid is used for boiler water and quench water pH control. Approximately two 55 gallon drums are stored on site in a bermed area. The berm is constructed the same as described above. The acid and caustic storage areas are located in accordance with the requirements of 40 CFR 261.

In the event of a spill from either the acid or caustic storage area, the berm would collect the spill. Absorbent clay and sand would be placed over the spill. The clay and sand would then be either drummed and disposed in accordance with applicable regulations or incinerated on site.
**

$$
3.6 POHC MATERIALS

The two hazardous chemicals that will be used for the RCRA trial burns to be conducted in April, 1987 are Hexachloroethane (HCE) and Trichlorobenzene (TCB). HCE is a solid at ambient conditions and thus present no unique spill potential problems. If, however, a spill occurs, then normal solids clean up procedures will be used. The spill will be scooped up along with any contaminated soil and processed in the incinerator along with the sand matrix which will be used for the Trial Burns. A front end loader and shovels are available for this task.

TCB is a liquid at the temperatures expected at NCBC during the trial burner. Therefore, bulk quantities of TCB will be placed in a barrel and lined storage area. If a spill occurs, sand or absorbant clay will be placed over the spill. The absorbed material will then be scooped up and processed in the incinerator. Following the Trial Burns, the remaining inventory of HCE and TCB will either be processed, returned to the manufacturer, or disposed as a hazardous substance.

Due to the hazards associated with HCE and TCB, additional health and safety measures will be enforced during handling of the raw material and any spills encountered. Those measures are discussed in the appended Ensco NCBC site specific Health and Safety manual.$$

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4.0 SPILL COUNTERMEASURES

Every hazardous waste spill is a unique event and therefore must be treated on a case by case basis. In the event of a hazardous liquid spill the following general steps will be taken to protect human health and the environment.

1. Upon discovery of a hazardous substance spill, evacuate all personnel from the immediate area and notify the Ensco Health and Safety Officer or his designated alternate. He can be contacted directly, on telephone extension 31, or on the two-way radios.

2. The health and safety officer will determine the risks and appropriate cleanup action.

3. Any tipped containers which maybe involved in the incident should be uprighted.

4. If appropriate, drip pans will be placed under any leaks or valve flanges. The collected material will be treated as hazardous waste.

5. The spill will be isolated in order to prevent contamination spread. To isolate a spill soil, straw or other absorbent material will be piled around the spill. Additional containment may be accomplished by using plastic as a liquid barrier.

6. The spilled material and absorbent material will be collected and disposed according to EPA requirements. Liquid material may be pumped into drums or other suitable containers. Solids may be shoveled into drums or the available earth moving equipment may be used to scrape up the material.

    If the spilled material is consistent with the material that the project is permitted to process, then the spilled material will be processed in the incinerator. If the permit does not allow

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processing the particular spilled material, then that material
will be drummed and sent to a hazardous waste disposal facility.

7. In all cases, every attempt will be made to prevent a spilled
    material from flowing into a storm drain or sewer. If in the
    unlikely event a spill does reach a storm drain or sewer, (601)
    the city of Gulfport sewer department will be notified at
    868-5765 or 863-0324.

8. The following government agencies will be notified of the spill,
    its extent, and the basic clean-up plan as soon as all personnel
    are protected.

    EPA Emergency Response Notification: (800) 424-9346
    Mississippi Dept. of Natural Resources: (601) 961-5171

    The following persons will also be notified in the event of a
    spill or any other on site emergency.

    Ensco Emergency Response, Gulfport,MS: (601) 863-0220
                             Little Rock AR (501) 375-8444
                             Louisiana   (504) 389-0988
    NCBC Duty Officer   (601) 865-2255
    NCBC Public Works Office   (601) 865-2484

5.0 HEALTH AND SAFETY PRECAUTIONS

In the event of spill the following health and safety precautions will be
taken as a minimum.

1. All personnel will be evacuated from the immediate area to an
    area upwind of the spill.

2. If fumes or vapors are being emitted from the spilled material, protective breathing devices must be worn. Scott Air Packs are stored in the Health and Safety Supply trailer which is located outside of the HO site.

3. Reentry to a spill area will require appropriate protective clothing such as Tyvek suits, rubber boots, gloves, goggles, and a hood.

4. If any individual has been splashed with toxic materials, flush the splashed area with large quantities of water from a safety shower or hose. If the victim's face or eyes are involved, an eye wash station should be used.

5. If the hazardous material gets on a person clothing, the clothing will be removed and the affected skin will be thoroughly washed. The clothing will be disposed as hazardous waste.

6. If personnel are injured, the ambulance will be called (865-2242) and the site doctor on call will be contacted (896-7311). The doctor is informed regarding the particular hazards of this project.

If a major spill has occurred which results in contamination of the environment, a site specific remedial action plan will be developed.

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INEL

Idaho National Engineering Laboratory

R. L. Billau *RLB*
D. J. Haley
T. H. Smith
Central Files
J. C. Loughead Letter Fil
Hazardous Waste Project.

April 27, 1987

Ms. Betty Willis
US EPA Region IV
345 Cortland St.
Atlanta, GA 30365

TRANSMITTAL OF REPLACEMENT PAGES - JCL-15-87

Dear Ms. Willis:

Enclosed for your review are thirteen (13) replacement pages for the NCBC
Trial Burn Plan. These replacements reflect your verbal comments to
Mr. Dan Haley last week.

Several other replacement pages will be transmitted to you after Mr. Haley
has clarified the specific issues raised. He should be contacting you in
the near future.

If you have any questions regarding this evaluation, please contact Mr.
Haley at the Gulfport Office, (601)-864-4139.

Very truly yours,

John S. C. Loughead
Hazardous Waste Projects

Enclosures:
As Stated

cc: Maj. T. L. Stoddart, USAF
    J. O. Zane, EG&G Idaho (w/o Encl.)

EG&G Idaho, Inc.   P.O. Box 1625   Idaho Falls, ID 83415

TABLE III.A.1 PHYSICAL/CHEMICAL COMPARISON OF COMPOUNDS

Chemical Name Units	Abbr.	B.P. (C)	M.P. (C)	Phase (S,L)	Hc (kcal/g)	V.P. (mm Hg)	Other Names
Hexachloroethane	HCE	186	187	S	0.46	0.4	Perchloro-ethane
2,4,5 TCPAA	245T	--	157	S	2.87	--	2,4,5-T
Trichlorobenzene	TCB	213	17	L	3.40	0.3	--
2378 TCDD	TCDD	î700	305	S	3.43	--	TCDD, Dioxin
2,4 DCPAA	24D	160	140	S	3.62	--	2,4-D

The POHCs will be batch mixed with the sand in a cement mixer. For each 9 cubic yard batch, at least 50 pounds of each POHC will be placed into the sand mixture in 4 discrete portions. This recipe will give a POHC concentration of 1500 to 3000 ppm. Between each portion, the mixer will be operated for approximately 10 minutes. After the final portion is added, the mixer will be operated for an additional hour to ensure a homogeneous mixture of sand and surrogate.

Approximately 25 batches of sand will be prepared.

The mixture will then either be stored in temporary tents or plastic lined staging piles or placed directly into the weigh hopper for processing.

The spiked feed matrix will be placed in a weighing hopper, then fed to the mobile system via the feed conveyor system. Feedstock sampling will be accomplished as the material is moved up this conveyor, as detailed in Section III.D.

III.D. Sampling Procedures

III.D.1. Sampling Locations

To evaluate the effectiveness of ENSCO's incinerator for treating a solid matrix containing trichlorobenzene (TCB) and hexachloroethane (HCE), Versar will collect the following samples for each of the six runs proposed in this trial burn plan:

o   Feedstock matrix

o   Treated solid residues

o   Stack gas

o   Neutralization tank (after each run)

o   Neutralization tank (after adsorption)

o   Neutralization tank background

o   Blanks.

Figure III.D.1 is a schematic diagram of the MWP-2000 incinerator showing
the locations where each of the above samples will be obtained. Feedstock
matrix samples will be obtained from the conveyor before the untreated
solids are transferred to the hopper. Solid residues will be sampled as
they fall off the ash drag conveyor into the solids collection bin. Stack
gas samples will be obtained on the stack via two 4 inch flanges which are
located 90 degrees apart approximately 6 feet before the top of the stack.
Two different types of neutralization samples will be obtained. After the
completion of each run (there are three runs per test) a grab sample will be
obtained from a sample port located on the effluent neutralization tank
recirculation pump. In addition, after all six runs have been completed, a
neutralization tank sample will be obtained from a sample tap immediately
after the water exits carbon adsorption but before the POTW holding tanks.
Before any tests begin, a background sample will be taken from the effluent
neutralization tank via a sample port located on the recirculation pumps. A
blank water sample will be obtained from a supply water tap. Blank samples
for stack gas sampling are described in the Quality Assurance Project Plan.
A blank composite sample of the solid matrix for this test will be obtained
from several fresh bags of sandblasting sand selected at random.

III.D.2. Sampling Collection Procedures

III.D.2.a. Feedstock Matrix. Samples of the feedstock matrix for each
run will be collected from the conveyor as the sand mixture is transferred
to the weigh hopper. Samples will be obtained by taking grab samples every
15 minutes during the run. A small clean sample scoop will be used to
obtain each grab sample. Each 15 minute sample will consist of three
sixteen ounce jars which will be filled by taking approximately nine

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The first sampling train used, a modified method 5 (MM5), and its operation will be in accordance with SW-846 procedures (Method 0010). As shown in Figure III.D.2, a total of 4 impingers will be used. Because the stack gases will be saturated, the first impinger will be large enough to capture 2 liters of condensate. To minimize the chance of field cross contamination, the XAD modules will be filled at the laboratory after the XAD has been cleaned. The sealed modules will only be opened for insertion and removal from the MM5 train.

The second train, a regular method 5 (M5), will be set up to capture particulate and determine HCl concentration. For that reason it will not require an XAD module, as did the MM5 train, and the second impinger will be loaded with an alkaline solution (100 mL of 0.1 normal NaOH) for chlorides determination; otherwise it will look exactly the same as the MM5 train. As is the case with the MM5 train, four impingers will be used and the first impinger will be large enough to collect 2 liters of solution. Prior to sampling the first impinger will also be loaded with 100 mL of 0.1 N NaOH. The particulate filter in the second sampling train will only be used to quantify the amount of particulate captured along with the probe rinsate (i.e., total particulate will be determined based on the particulate collected on the filter and any particulate in the probe rinsate). The following procedure will be used to accomplish this test objective:

Step 1: Particulate filters will be dryed in a clean desiccant box for a minimum of 24 hours.

Step 2: Each filter will be pre-weighed and weight will be recorded.

Step 3: The filter will be used in the second MM5 train.

Step 4: The filter will be carefully removed from its glass container and placed in a clean desiccant box for 24 hours.

Step 5: The filter will be weighed.

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Table III.D.1 (continued)

21. Percent Moisture by Volume	Bws	38.58%		NA	
22. Percent Moisture by Saturation	Bws'	49.11%			
23. Mole Fraction of Dry Gas	Fmd	0.5889		NA	
24. Gas Analysis					
Average CO2 by Volume	CO2	9.38	%	NA	
Average O2 by Volume	O2	6.13	%	NA	
Average CO by Volume	CO	0.00	%	NA	
Average N2 by Volume	N2	84.58	%	NA	
25. Dry Molecular Weight of Stack Gas	Md	29.75	lb/lb-mole	NA	
26. Molecular Weight at Stack Conditions	Ms	23.38	lb/lb-mole	NA	
27. Average Stack Temperature	Ts	644	R	357.4	K
28. Average Stack Gas Velocity	Vs	56.59	ft/sec	17.29	m/sec
29. Stack Area	As	706.9	sq-in	0.456	sq-m
30. Actual Stack Gas Flowrate	Qs	999,981	ACFH	28,319	ACMH
31. Dry Stack Gas Flowrate (Standard)	Qsstd	424,753	SCFH	12,029	SCMH
32. Iso - Kinetic Rate		75.6	%	NA	
33. Weight of Filterable Particulates	Mn	24.1	mg	NA	
34a. Particulate Concentration (at standard conditions)	Cs	1.07E-09	lb/DSCF	NA	
		0.48	mg/DSCF	NA	
		0.007	gr/DSCF	NA	
		17.065	mg/DSCM	NA	
34b. Particulate Concentration ('Corrected to 7% O2)	Cs6%O2	1.07E-09	lb/DSCF	NA	
		0.49	mg/DSCF	NA	
		0.008	gr/DSCF	NA	
		17.218	mg/DSCM	NA	
34c. Particulate Concentration (corrected to 12% carbon dioxide)	Cs12%CO2	1.36E-09	lb/DSCF	NA	
		0.62	mg/DSCF	NA	
		0.010	gr/DSCF	NA	
		21.844	mg/DSCM	NA	
35. Pollutant Mass Rate	PMR	4.53E-04	lbs/hr	NA	
		205.3	g/hr	NA	
		3168	gr/hr	NA	

Pressure differential across the demister is measured by a differential pressure transmitter which transmits to the data acquisition and control computer.

Stack and Gas Monitoring:

The stack is fabricated of fiberglass reinforced plastic and is 35'10" from the trailer bed and approximately 40'10" from ground level. The stack is equipped with sampling ports and an access platform to these ports to facilitate sampling during demonstration tests. It has three sections.

Lower Section	ID 36 to 30 inches	Height 8'10"
Reducer Section	ID 30 inches	Height 13'6"
Upper Section	ID 30 inches	Height 13'6"

The stack is equipped with a gas sampling system that collects, conditions, and delivers a continuous stack sample stream to oxygen, carbon monoxide, and carbon dioxide analyzers located in the control room. These analyzers continuously analyze the sample stream and transmit results to the data acquisition and control computer. Additionally, the oxygen, carbon monoxide, and carbon dioxide analyzers transmit results to strip chart recorders to provide a redundant recording of these parameters. The oxygen and carbon monoxide analyzers also transmit to alarms on the control panel (a low-level alarm for oxygen and a high-level alarm for carbon monoxide) and to the AWFSO circuit.

Stack outlet gas temperature is measured by a thermocouple that transmits to an indicator on the control panel and to the data acquisition and control computer.

Stack condensate is continuously sampled and analyzed for pH by a probe assembly and analyzer on the stack. Measurements of pH are transmitted to the pH indicator controller which controls the injection of caustic into the ejector scrubber recirculation line. These parameters are monitored by the data acquisition and control computer.

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TABLE 3.1. QUALITY ASSURANCE OBJECTIVES FOR PRE~~ON~~, ACCURACY AND COMPLETENESS FOR COMBUSTION AND OPERATING PARAMETERS

Parameter	Method of Measurement	Precision[a] (%)	Accuracy[b] (%)	Completeness[c] (%)
Rotary Kiln Gas Temperature	Thermocouple			
SCC Temperature	Thermocouple	5	5	90
Carbon Monoxide	Beckman Infrared Detector	5	5	90
Carbon Dioxide	NDIR[d]	1% of Full Scale	1% of Full Scale	90
Oxygen	Micro-fuel cell	1% of Full Scale	1% of Full Scale	90
Kiln Air Feed Rate	Annubar	1% of Full Scale	1% of Full Scale	90
SCC Air Feed Rate	Annubar	5	5	90
Soil Mass Feed Rate	Load Cell	5	5	90
Feed Auger Speed (RPM)	Proximity Probe	5	10	90
		5	10	90

a. Expressed as relative standard deviation.

b. Expressed as percentage difference from the true (standard) value.

c. Expressed as the amount of valid data obtained compared to the total amount expected.

d. Non dispersive infrared detector.

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The feed auger has a variable speed control which will be used to determine the feed rate to the kiln. The kiln feed rate is a function of:

1. Auger speed.

2. Bulk density of the solid waste to be incinerated, including:

   a. Type of waste and its composition.

   b. Moisture content of the waste.

3. Percentage of loading in the auger flights.

The bulk density of the waste will be determined analytically prior to the trial burn for sand and has been determined for the native soils at the NCBC. However, the determination of the percentage of auger flight loading will require field observation and development of feed curves. This may be done during clean soil test.

The auger RPM will be interlocked, and the set point for the interlock will be determined from the feed curves referenced.

II.F. Prime Mover Capacity Description

The prime mover for the MWP-2000 is a single steam powered jet venturi scrubber that was manufactured by Hydrosonics, Inc. to develop a negative pressure of 25 inches wc.

II.G. Automatic Waste Feed Shut-Off (AWFSO) Circuit Description

The control trailer/motor control center (MCC) houses the automatic waste feed shut-off (AWFSO) and the flame supervision systems servicing the kiln burner and the secondary combustor burner. Each of the referenced burners are controlled by an independent flame supervisor. These interconnected circuits are configured to handle the upset conditions detailed below.

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TABLE III.E.3.1   ANALYSES PLANNED FOR NCBC TRIAL BURN

Test	Sample	Matrix	Type	Target(s)	Anal.	Extr.
BACKGROUND						
	Feedstock	Solid	Background	HCE, TCB	8270 GC/MS	3550 Sonication
	Ashdrag	Solid	Background	HCE, TCB	8270 GC/MS	3550 Sonication
	ENT	Liquid	Background	Archive	(1)	
	Potable	Liquid	Background	Archive	(1)	
	Sand	Solid	Background	Archive	(1)	
	Acetone Wash	Liquid	Background	Archive	(1)	
	Caustic	Liquid	Background	Archive	(1)	
RUN 7-A						
	Feedstock	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT	Liquid	Grab	Archive	(1)	
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic	HCl	EPA Method 325.3	
RUN 7-B						
	Feedstock	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-7550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT	Liquid	Grab	Archive	(1)	
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic	HCl	EPA Method 325.3	
RUN 7-C						
	Feedstock	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT	Liquid	Grab	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic	HCl	EPA Method 325.3	

(1) - Analyzed only if contamination is suspected.

TABLE III.E.3.1   ANALYSES PLANNED FOR NCBC TRIAL BURN

Test	Sample	Matrix	Type	Target(s)	Anal.	Extr.
RUN 8-A						
	Feedstock	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT	Liquid	Grab	Archive	(1)	
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic	HCl	EPA Method 325.3	
RUN 8-B						
	Feedstock	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT	Liquid	Grab	Archive	(1)	
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic	HCl	EPA Method 325.3	
RUN 8-C						
	Feedstock	Solid	Composite	HCE. TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Feedstock	Solid	Duplicate	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	Ashdrag	Solid	Composite	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT (2)	Liquid	Grab	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Solid	Filter	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Solid	XAD	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	MM5	Liquid	Condensate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5	Liquid	Rinsate	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel
	MM5 Blank	Solid	Field Blank	HCE, TCB	SW846-8270 GC/MS	SW846-3540 Soxhlet
	Method 5	Solid	Filter	Particulate	EPA Method 5	
	Method 5	Liquid	Rinsate	Particulate	EPA Method 5	
	Method 5	Liquid	Caustic	HCl	EPA Method 325.3	
POST-TEST						
	ENT FINES (3)	Solid	Grab	HCE, TCB	SW846-8270 GC/MS	SW846-3550 Sonication
	ENT (4)	Liquid	Grab	HCE, TCB	SW846-8270 GC/MS	SW846-3510 L/L Funnel

(1) - Analyzed only if contamination is suspected.
(2) - BOD, COD as per MS Effluent Permit.
(3) - Analyzed only if Scrubber Fines are present.
(4) - Sample taken after Carbon Adsorption.

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TABLE III-G-1. OPERATING CONDITIONS AND MONITORED PARAMETERS

Parameter	Normal Set Point
Nominal Soil Feed Rate	Test 7: 4.0 ton/h, Test 8: 5.0 ton/h
Soil Residence Time	Variable 20 - 60 min, Kiln RPM to remain constant during each test.
Kiln Combustion Air Flow Rate	120 lbs/min
Kiln Outlet Gas Temperature[a]	1350 - 1800_F
Kiln Pressure[a]	negative pressure
SCC Combustion Air Flow Rate	300 lbs/min
SCC Outlet Gas Temperature[a]	2100_F minimum
SCC Pressure	negative
Gas Residence Time in SCC[a]	1.0 - 2 seconds
Combustion Efficiency[a]	99%
Boiler Outlet Gas Temp	450_F
Boiler Steam Pressure	220 - 240 psig
Steam Drum Level	30 - 60%
Boiler Makeup Water Flow Rate	20 - 30 gpm
Quencher Recirulation Water Flow Rate	100 gpm
Quencher Makeup Water Flow Rate	15 gpm
Quencher Outlet Gas Temperature	190_F
Packed Tower Recirculation Water Flow[a]	approximately 170 gpm or as necessary to achieve required scrubber efficiency
Packed Tower Makeup Water Flow Rate	15 gpm

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Listed below is a general time sequence of events for each day of testing.

Approximate Time	Action
01:00	Complete warmup so that the unit is at full operating conditions as specified in Table III-G-1.
02:00	Begin feeding clean non-surrogate spiked sand to the incinerator at a feed rate of 4.0 ton/h for Test 7 and 5.0 ton/h for Test 8.
	Continue to feed the clean sand to the incinerator for 4 hours.
NOTE:	This step does not have to be duplicated if similar action was taken as described in Section III.G.7.a
06:00	Check to ensure that the unit has reached full equilibrium conditions. The kiln and Secondary temperature should be steady to within +/- 50°F for at least 2.5 hours.
	If the kiln and SCC temperatures have reached thermal equilibrium on clean sand, begin feeding surrogate spiked sand to the incinerator at a feed rate of 4.0 ton/h for Test, and 5 tons/h for Test 8.
	Continue to feed the spiked sand to the incinerator for approximately 1.5 hours to reach equilibrium on spiked sand. Continue to monitor kiln and SCC temperatures to ensure that thermal equilibrium is maintained.
09:00	Upon concurrence of the sampling subcontract manager and the incinerator operations manager, the sampling crew will be directed to begin sampling according to the established protocol in Section III-D.
12:00	The stack test will take approximately three hours to complete. Upon completion of the stack test, the sampling crew will begin clean-up operations.
12:20	Approximately twenty minutes after the gas sample is completed, the stack sampling crew will direct the incinerator operations crew to discontinue feeding of waste to the incinerator. Incinerator feeding for the extra twenty minutes is necessary in order to obtain complete and accurate waste feed rate information.

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Gases or vapor phase constituents in the flue gas are assumed to be homogeneously distributed in the stack and not stratified and therefore may be representatively collected from a single point in the stack. Gases (CO, CO_2, O_2) will be monitored continuously during each test run.

3.3A Comparability

All sample data will be presented in comparable units as follows:

Measurement	Units
Gas volumes	dry standard cubic meter (dscm)
Gaseous constituents	volume percent
Stack temperature	average F
Stack velocity	average ft/sec at stack exit
Stack flow	average dscm/minute

Triplicate sampling runs will be conducted for each test. The comparability of the triplicate data sets will be addressed in the final QA report.

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The amount of HCl in the stack gases will be analytically determined based on total chlorides (from the M5 stack test) and reported in both mg/kg and kg/hr. Because of the low chloride load on the system, 3000 ppm HCE and TCB respectively, it is impossible to exceed the EPA limit of 4 pounds of chlorine per hour.

8.2A Data Validation

The principal criteria that will be used to validate the integrity of the gaseous data emissions measured by the continuous monitors will be discrete analyses using ORSAT-type measurements which will be taken directly at the stack. These values will be correlated with the gaseous emissions readings and any discrepencies will be recorded.

The principal criteria that will be used to validate the integrity of the stack field data which is essential to calculate emission levels (POHC, particulate, HCl) will be the following:

(1) Examination of all field data forms by the Quality Assurance Officer.

(2) Verification of calculations for one test run by an independent, second reviewer.

(3) Reporting of all associated blanks, standards, and calibration data along with reported results.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

MAY 1 1987

WD-RM

Captain C. M. Maskell
CEC, U.S. Navy
Commanding Officer
Naval Construction Battalion Center (NCBC)
Gulgport, MS 39501

Dear Captain Maskell:

By this letter we are approving the April 17, 1987, plans as revised
April 27, 1987, for the trial burn using Dioxin surrogates in the ENSCO
MWP 2000 incinerator at the Naval Construction Battalion Center,
Gulfport, Mississippi subject to the changes listed below:

1. Test the stack for cyclonic flow using EPA Method 1 or supply data
    from the December Method 1 test to EPA before beginning the trial burn.

2. Record the auger rpms on a continuous strip chart recorder.

3. Use Table III.E.3.1 on pages III-25 and 26 as the list of samples to
    be taken and the analytical and extraction procedures, except that
    "(2)-BOD, COD" is to be done on the Post-Test ENT sample instead of
    the Run 8-C ENT sample.

4. If necessary to provide a more homogeneous mixture of the POHC and
    sand, you can mix the TCB (trichlorobenzene) with cotton seed hulls
    and sand. However, you must use the minimum amount of cotton seed
    hulls necessary to evenly disperse the TCB.

During the trial burn Betty Willis of my staff will discuss with you the
questions we have regarding the TRV (thermal relief valve), stack height,
residence time, AWFSOs (automatic waste feed shut offs), etc. These
operational issues should be resolved before the trial burn report is
submitted.

EPA will have at least two employees on site for the duration of the
trial burn. Please notify Caron Falconer or Betty Willis if there are
any changes in the trial burn schedule.

Sincerely yours,

Patrick M. Tobin, Director
Waste Management Division

cc: Sam Mabry, Mississippi, DNR
      Major Stoddart, USAF

PROPOSED MODIFICATION IN POHC ADDITION AT NCBC FULL-SCALE

Introduction

The batch mixing operation that was presented in Section III-G of the NCBC Trial Burn Plan has been tried as a "dry-run" at NCBC, and is found to be less than ideal. For reasons that can not be confirmed at this time, reliable coorelations between the bulk recipe and analytically determined POHC concentrations are not possible. Initial trial mixes have varied up to 75% between recipe and analysis.

Several mechanisms have been considered as contributing to such a mass loss, with ambient release during the vigorous mixing stage and/or stratification or incomplete mixing suspected for the apparent loss of feedstock concentration. Because the source of this discrepancy cannot be conclusively identified and might involve an unquantified air release, the Trial Burn was postponed by the USAF until either the source of the apparent loss was confirmed or an alternative method was developed.

The purpose of this document is to propose an alternative preparation method, as was suggested by EPA Region IV staff on May 5, 1987. This proposal incorporates the preparation and introduction of discrete (1.5 lb.) POHC filled containers throughout each test run on a specific time interval (every 3 minutes.)

The various aspects of this alternative method are summarized below.

Preparation

A uniform volume (e.g. one pint) of each POHC would be placed in a suitable container, and will be checked against the minimum acceptable weight for that volume (e.g. 1 1/2 lb). This will be accomplished by placing each container on a beam balance (preset to the target weight) and insuring that the filled container "tips the balance." In addition to this check at the time of preparation, 10 % of the containers will be randomly weighed to confirm an average mass and a variance for all containers.

Addition to the Kiln

The containers will be placed in the elevated feed hopper which includes the feed auger assembly. The containers will be cast into the feed hopper on a regular time interval (e.g. every three minutes), so that the calculated ratio of POHC to feed material is 3000 - 4000 ppm. The containers would be introduced through a small access port in the cover shroud on the feed hopper, and directed toward the feed auger. The feed auger hydraulic drive possesses ample power to fracture the containers as they enter the kiln, thus releasing the POHC to the sand matrix as it drops to the kiln bed.

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With each container containing 1 1/2 lb of POHC being cast into
the incinerator every three (3) minutes, the following feedrate
concentrations would be realized:

Feedrate	Feed Concentration
4 tons/hour	3800 ppm
5 tons/hour	3000 ppm

These concentrations will be sufficient to demonstrate DRE values
of 99.9999% or greater, based on analytical detection limits for the
MM5 stack train and three (3) hour run durations.

The sand feedrate will be maintained at the target feedrate
throughout each run. Because level "A" safety protection will be
unnecessary for the soil handling crew, greater control and
communication will be possible in this previously high risk area.

Reporting

The POHC addition activity will be monitored by a remote observer,
and any unavoidable anomalies will be included in the trial burn
report.

The auger speed will be continuously recorded on a strip chart
device, as previously discussed with EPA Region VI staff.

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN (QAPP) FOR
MWP-2000 INCINERATOR SYSTEM TRIAL BURN AT NCBC

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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QUALITY ASSURANCE PROJECT PLAN (QAPP)
RCRA SOLID TRIAL BURN PLAN AND ANALYSIS
OF ENSCO's MWP-2000 INCINERATOR
DURING THE TREATMENT OF SOLIDS CONTAINING
HCE AND TC3 AT NCBC GULFPORT, MS

Prepared For:

U.S. EPA REGION IV
345 Courtland St. N.E.
Atlanta, GA   30365

Prepared By:

U.S. Air Force
Engineering and Services Center
Tyndall AFB, FL

This Quality Assurance Project Plan for conducting an emission test of ENSCO's MWP-2000 incinerator at NCBC in Gulfport, MS has been reviewed and approved by:

Major Terry Stoddart
USAF Project Officer

_____

Dan Haley
EG&G Project Manager

_____

Darrell B. Derrington, Jr., P.E.
Versar Project Manager

_____

Art Jung
Versar Quality Assurance Officer

_____

CONTENTS

1.0 PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) presents, in specific terms, the policies, organization, objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities which will be used to achieve data quality for sampling and analysis of this RCRA Trial Burn project. The objective of the sampling project is to collect samples during the operation of ENSCO's MWP-2000 incinerator while it is processing a solid matrix containing hexachloroethane (HCE) and trichlorobenzene (TCB) at the Naval Construction Battalion Center (NCBC) in Gulfport, MS. The samples, which will be obtained by Versar, Inc., will be sent to IT Corporation's analytical laboratory in Knoxville, TN for final analysis.

The United States Air Force (USAF) intends to restore the site at NCBC, which was previously used to store Herbicide Orange, to beneficial use through the research and test evaluation of a thermal technology. As a result of storing Herbicide Orange on the site, the soil has become contaminated with 2,3,7,8-TCDD, and other chlorinated organics, which were contained in the Herbicide Orange. The site clean up focuses on the use of a mobile rotary kiln incinerator which will thermally destroy all organics in the soil during treatment. Before the Air Force can continue the R&D permitted activity, the rotary kiln must be tested and sampled during actual operation so that a DRE of at least six-nines can be established while treating a dioxin surrogate material that has a lower heat of combustion than TCDD.

The technology to be sampled is ENSCO's MWP-2000 (Mobile Waste Processor) incinerator which has been set-up onsite at NCBC. This activity is being performed under the auspices of an RD&D permit from Region IV EPA. For this trial burn two different tests will be performed on the incinerator to demonstrate six-nines DRE operation. As is required in a RCRA trial burn, each test will be performed in triplicate. During each test the samples

summarized in Table 1 will be obtained. The trial burn will consist of six separate runs which will be performed over a period of about 10 days. The first test will be conducted at a solids feed rate of 4 tons per hour. The second test will be conducted at a solids feed rate of 5 tons per hour.

To insure that the incinerator is not operating in a transient mode, sampling during the trial burn will not begin until steady state operation has been established. It is anticipated that approximately five hours of operation will be required to reach steady state operation at a minimum solids feed rate of three tons per hour. Less time may be needed at higher soil feed rates and when the incinerator will not have to be brought up to temperature from a cold start condition.

The sections that follow contain all of the information required in a QAPP as dictated by Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans. Please note that the QA/QC sections applicable to Sampling are discussed in Sections 3.0A through 15.0A. The sections applicable to Analysis are discussed in Sections 3.0B through 14.0B.

2.0   PROJECT ORGANIZATION AND RESPONSIBILITY

This RD&D Project is being performed as part of the Installation Restoration Program within the United States Air Force and is being directly managed through Tyndall Air Force Base. The Air Force project director is Major Terry Stoddart. The prime contractor to the Air Force for the NCBC demonstration program is EG&G Idaho, Inc. Mr. Dan Haley is EG&G's program manager. Environmental Systems Company (ENSCO) is a subcontractor to EG&G that provides hardware and operation of the mobile incineration system that is the object of this RD&D effort. Versar, Inc. is providing overall onsite sampling support and analytical services are being provided by IT Corporation in Knoxville, TN.

PART A--OPERATION AND SAMPLING

3.0A QUALITY ASSURANCE OBJECTIVES--OPERATIONS AND SAMPLING

The quality assurance objectives for this project will be to provide
reliable sampling and analytical data for documenting HCE and TCB
concentrations in the feedstock solid matrix, treated residue,
neutralization tank water, and stack gases for ENSCO's incinerator during
treatment of the dioxin surrogate at NCBC. Specific objectives for
precision, accuracy, and completeness, as applicable to operations and
sampling activities are presented in Table 3-1. As part of the overall
measurement objective of the trial burn tests, the mobile incineration
system must be evaluated for the capability of:

o   Operating at the conditions set forth in the RCRA regulations

o   A 99.9999% DRE of the dioxin surrogates in the incineration feed.

3.1A Precision, Accuracy, and Completeness

The regulations require continuous monitoring of contaminant mass flow rate
and combustion temperature as well as flue gas concentrations of CO, CO2
and O2. In addition to these parameters, the RCRA interim regulations
require monitoring of the air feed rate. The data for these parameters
must be precise, accurate, and complete. The objectives for precision,
accuracy, and completeness of data for the parameters identified above are
given in Table 3-1. Definitions of these terms are as follows.

Accuracy. The degree of agreement of a measurement (or an average of
measurement of the same parameter), X, with an accepted reference or true
value, T, usually expressed as the difference between the two values, X-T,

TABLE 3.1. QUALITY ASSURANCE OBJECTIVES FOR PRECISION, ACCURACY AND COMPLETENESS FOR COMBUSTION AND OPERATING PARAMETERS

Parameter	Method of Measurement	Precision[a] (%)	Accuracy[b] (%)	Completeness[c] (%)
Rotary Kiln Gas Temperature	Thermocouple	5	5	90
SCC Temperature	Thermocouple	5	5	90
Carbon Monoxide	Beckman Infrared Detector	1% of Full Scale	1% of Full Scale	90
Carbon Dioxide	NDIR[d]	1% of Full Scale	1% of Full Scale	90
Oxygen	Micro-fuel cell	1% of Full Scale	1% of Full Scale	90
Kiln Air Feed Rate	Annubar	5	5	90
SCC Air Feed Rate	Annubar	5	5	90
Soil Mass Feed Rate	Load Cell	5	10	90

a. Expressed as relative standard deviation.

b. Expressed as percentage difference from the true (standard) value.

c. Expressed as the amount of valid data obtained compared to the total amount expected.

d. Non dispersive infrared detector.

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or the difference as a percentage of the reference or true value,
100(X-T)/T. Accuracy is a measure of the bias inherent in the system.

Precision. A measure of mutual agreement (or variability) among individual
measurements of the same property, usually under prescribed similar
conditions and usually expressed in terms of the standard deviation.
Various measures of precision exist, depending on the prescribed similar
conditions.

Completeness. A measure of the quantity of valid data obtained from a
measurement system compared to the quantity that was expected to be
required to fully evaluate and understand the system under optimum
conditions, usually expressed as a percentage.

3.2A Representiveness

3.2.1A Feedstock Matrix and Treated Residue Samples

It is estimated that approximately four hours will be required to complete
each trial burn run. To obtain representative samples of the feedstock and
treated residue during this time period, each will be sampled at 15 minute
intervals. Each 15 minute sampling episode will consist of at least 9
grabs with a sample scoop to obtain a volumetrically measured sample of 48
ounces. Sampling of the feedstock matrix will begin 10 minutes before each
test. Sampling will continue for the duration of each test. Starting
feedstock matrix sampling before the test begins is intended to take into
the account the residence time of the solids in the feed hopper system.
Because the solid matrix will have been homogeneously prepared, sampling at
15 minute intervals over a 4 hour run period should be more than adequate
to assure that a representative feedstock sample has been obtained.

Because the residence time of the solids in the rotary kiln is about 30 minutes at a soil feed rate of 4 tons per hour, sampling of treated residue will be delayed a similar amount of time after initiation of each test. Because this trial burn is being performed with a homogenous feed and the incinerator will be operated at steady state conditions, sampling the treated residue every 15 minutes should be more than adequate to assure that a representative sample has been obtained.

3.2.2A Neutralization Tank Water Samples

Grab samples from the neutralization tank will be obtained after each run is complete. A background sample will have been collected prior to any testing. The water in the effluent neutralization tank is constantly recirculated and will represent the water used during the entire run. The grab sample will be taken directly from a sample tap located on the effluent neutralization tank. Before obtaining each sample, the sample tap will be flushed of any potentially stagnate liquid. The final effluent neutralization tank sample will be taken after all testing is complete. The sample will be obtained from an in-line sample tap after the carbon adsorption system, but before the POTW holding tanks.

3.2.3A Stack Emissions

To obtain a representative sample, the particulate and gaseous stack emissions will be collected using two sampling probes (attached to a modified method 5 (MM5) sampling train and a method 5 (M5) sampling train) which will traverse the stack according to procedures established in EPA (40 CFR 60, Appendix A) Reference Method 2. Isokinetic sampling will be established by sampling at flow rates equal to the stack gas velocity along specific points inside the stack along two dimensions, 90 degrees apart. The total stack sampling time will be 120 minutes which will require about four hours to perform.

Gases or vapor phase constituents in the flue gas are assumed to be
homogeneously distributed in the stack and not stratified and therefore may
be representatively collected from a single point in the stack. Gases (CO,
CO2, O2) will be monitored continuously during each test run.

3.3A Comparability

All sample data will be presented in comparable units as follows:

Measurement	Units
Gas volumes	dry standard cubic meter (dscm)
Gaseous constituents	weight percent
Stack temperature	average F
Stack velocity	average ft/sec at stack exit
Stack flow	average dscm/minute

Triplicate sampling runs will be conducted for each test. The
comparability of the triplicate data sets will be addressed in the final QA
report.

4.0A SAMPLING PROCEDURES

4.1A Incinerator Operating Parameters

The waste solids feed rate to the rotary kiln is controlled by a weigh
hopper and a variable speed screw auger that introduces the solid feed to
the kiln. The weigh scale will be calibrated before the trial burn
according to the manufacturers recommendations. An operator will manually
record the differential weight on the weigh hopper each time solids are
charged to the hopper.

The flue gas concentrations will be continuously monitored via a sample
drawn from the stack. The gas sample is conditioned (i.e., moisture and
solids are removed) before being introduced into the analyzer which is
described in Section II of the trial burn plan.

The temperatures at the rotary kiln and secondary combustor outlets will be
monitored with thermocouples in direct contact with the flue gases. The
thermocouples are shielded from the burner flames to eliminate temperature
measurement error associated with flame radiation. More details concerning
the thermocouples are contained in Section II of the trial burn plan.

4.2A Feedstock Matrix

Samples of the feedstock matrix will be collected from the conveyor as the
sand mixture is transferred to the hopper. Samples will be obtained by
taking grab samples every 15 minutes during the test. A small clean sample
scoop will be used to obtain each grab sample. Each 15 minute sample will
consist of three sixteen ounce jars which will be filled by taking grab
samples at different locations across the width of the moving conveyor
belt. A representative composite sample will be prepared by homogenizing

the equal portions of 15 minute samples after each run has been completed.
Homogenization will be performed manually by mixing the samples together
using a ring and cone pattern with the sample scoop in a clean wheel
barrow. After homogenizing, the samples will be placed in clean jars with
Teflon-lined lids. As required, sample splits will be provided to EPA or
their designated onsite representative.

4.3A Treated Solid Residue

Grab samples of treated residue from the ash drag sump will be obtained
using a small clean sample scoop to catch samples as the residue falls off
of the ash drag conveyor into the ash drag bin. Samples will be collected
every 15 minutes. Care will be exercised to collect individual grab
samples from various locations in the residue stream. Each 15 minute
sample will consist of three sixteen ounce jars which will be filled as the
individual grab samples are taken. The jars will be emptied into a clean
stainless steel bucket which will be stored in a clean plastic bag when not
being filled or emptied. A representative composite sample will be
prepared by manually homogenizing all samples with the sample scoop in the
stainless steel bucket after each run. After homogenizing, samples will be
placed in clean jars with Teflon-lined lids.

4.4A Stack Gas

4.4.1A Continuous Monitoring

Stack effluent gases (CO, CO2, and O2) will be continuously monitored
during each 4-hour run period using ENSCO's on-line instrumentation as
previously described. To verify proper operation of ENSCO's gas monitoring

equipment, Versar will perform discrete tests at the stack using an
ORSAT-type apparatus to determine CO, CO2 and O2 flue gas concentrations.
These data points can then be correlated to ENSCO's continuous readings.
During each 4 hour run period, a minimum of 3 discrete analyses will be
performed.

4.4.2 A Modified Method 5 and Method 5

During each test two sampling trains, a Method 5 (M5) and Modified Method 5
(MM5), will be used to sample for potential Principal Organic Hazardous
Constituents (POHC's), particulate, and HCl.

The sampling trains and their operation will be in accordance with MMA's
procedures (EPA-600/8-84-002). An alkaline solution (0.1 N NaOH) will be
used in the first and second impingers to trap acid vapors and to quantify
for HCl in the M5 train. One of the requirements of the method is that no
grease be used for sealing joints in the train. Viton O-rings will be used
to seal all joints prior to and including the first impinger.

4.4.3A Sample Preservation and Transport

Feedstock and treated solid residue samples will be bottled in appropriate
containers and packaged in DOT approved containers for shipment. All
aqueous samples and samples from MM5 sampling will be properly bottled and
packed in ice inside of coolers for shipment. All shipping will strictly
adhere to DOT approved procedures.

5.0A SAMPLE CUSTODY

Labelling and identification of all samples collected will be done using
Versar's three part label which is shown in Figure 5-1. Both upper
portions and the single lower portion have pre-printed numbers that become
the field sample number. The upper portions will be completed and affixed
to the sample bottle; the lower portion will be entered into the field
notebook with pertinent information entered along side. All duplicate
samples (or any number of replicates) will have the same field sample
numbers assigned to corresponding parameters. In some case, this may
require use of handwritten labels in addition to the pre-printed labels.
The exception to replicate label numbering will be in the case of "blind"
duplicates for QA/QC purposes; each sample will then be labeled and
documented separately.

Sample custody will begin, in all cases, at the time of sample collection
by placing the sample into an iced cooler, or appropriate container, in the
possession of the designated field sample custodian. A line item on the
field chain of custody form (Figure 5-2) will immediately be filled out and
initialed by the field sample custodian. The following procedures will be
followed when completing the chain of custody form:

PROJECT NO.   Enter the completa project number; enter the
                     analytical subtask number (usually an odd number) not
                     the sampling subtask number.

PROJECT NAME   Enter the project name as it is listed on the
                     Contract Status Summary Sheets distributed
                     periodically throughout Versar.

SAMPLERS   Enter signature and print name of person or person(s)
                     who participated in the collection of the samples
                     listed, and who should be contacted should questions
                     arise during sample log-in. If the field sample
                     custodian is not listed as a sampler, receipt
                     documentation should be indicated.

VERSAR INC.

13050 ———————— } AFFIXED TO SAMPLE CONTAINER
         PARAMETER

13050   DUPLICATE } AFFIXED TO DUPLICATE SAMPLE
                             (E.G., VOA SAMPLES)

VERSAR INC.

13050 ————————
         PARAMETER

——————————————
         TAGS

——————————————   } ENTERED IN FIELD NOTEBOOK AS
PLANT   PERMANENT SAMPLE IDENTIFICATION

——————————————
SAMPLE LOCATION

——————————————
MATRIX

——————————————
SAMPLING COMMENTS

——————————————
SIGNATURE   TIME/DATE

Figure 5-1.   Versar's Three Part Sample Label.

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CHAIN OF CUSTODY RECORD

PROJECT NO. 123.4.5

PROJECT NAME: Chesapeake Bay Water Quality

SAMPLERS (Signature): Jim Jones

(Printed): Jim Jones

FIELD SAMPLE NUMBER	DATE	TIME	GRAB	COMP	STATION LOCATION	NO. OF CONTAINERS											REMARKS
	7/19	0900	X		Thomas Point (Bay 18)	6	74	71	75	81							PRSFX 095--
	7/20	1130	X		Lea Point (Bay 15)	4	72	73	84	88	87						PRSFX 095--
	7/21	0955	X		Crownie Beach (Bay 23)	3	73	74	88		69	90					PRSFX 095--

Relinquished by: (Signature) Jim Jones
(Printed) Jim Jones
Date/Time 7/21 1900

Received by: (Signature) Jack Johnson
(Printed) Jack Johnson

Relinquished by: (Signature) Jack Johnson
(Printed) Jack Johnson
Date/Time 7/21 1965

Received for Laboratory by: (Signature) Bill Boyd
(Printed) Bill Boyd

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FIELD SAMPLE NUMBER   This box does not generally apply to MAD procedures
and should be left blank.

DATE   Enter date of sample collection. If sample is a
composite indicate both start and finish date.

TIME   Enter time of actual sample collection. If sample is
a composite indicate both start and finish time.

COMP./GRAB   Indicate by a check the type of sample.

STATION LOCATION   Enter a description of location as well as any
location code that has been assigned.

NUMBER OF CONTAINERS Enter the actual number of sample bottles to be
submitted to the laboratory.

PARAMETERS   List parameters to be analyzed; if abbreviations or
parameter categories (e.g., ICP metals) are used
further details must be given when logging in samples.

For each line entry indicate the last two digits in
the sample number. Enter first three sample number
digits in remarks section as shown in Figure 5-2.

INDUSTRIAL HYGIENE   Circle the appropriate box to indicate type of
SAMPLE   sample.

Upon completion of all line items, or upon sample pick-up, the custodian
will sign, date and list time, and will confirm completeness of all
descriptive information contained on the form. Each individual who
subsequently assumes responsibility for the sample will sign the chain of
custody form and the reason for assuming custody. The field chain of
custody form terminates upon laboratory receipt of samples. The field
sample custodian should obtain the pink copy of the chain of custody form
for program files.

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SECTION 6.0A CALIBRATION PROCEDURES AND FREQUENCY

6.1A Sampling Equipment

6.1.1A Method 5 and Modified Method 5 Equipment

Table 6-1 summarizes the sampling apparatus to be calibrated, the
acceptance criteria, the method, and the frequency of calibration. Prior
to the test the gas metering device is calibrated against a positive
displacement wet test meter. The calibration factor is rechecked after the
test.

Temperature sensors are calibrated against an ASTM mercury-in-glass
thermometer, and/or are calibrated in an ice bath and a boiling water bath.

The aneroid barometer is checked against a mercury column barometer.

The pitot tubes are constructed according to the design criteria of EPA
(40 CFR 60, Appendix A) Reference Method 2. In addition, the S-type pitot
tubes are calibrated against a standard pitot tube in a wind tunnel, if the
specified design criteria are not met.

6.1.2A Operations

The calibration criteria for the continuous gas monitoring equipment,
thermocouples and solids weigh hopper are discussed in Section II of the
trial burn plan.

Table 6-1. Calibration of Sampling Apparatus

Parameter	Calibration technique	Reference standard	Acceptance limit	Calibration frequency	Reference procedure
1. Probe nozzle	Measure diameter to nearest 0.001 in.	Micrometer	Mean of three measurements; difference between high and low ≤ 0.1	Prior to test	RH5[a]
2. Gas meter volume	Compare to wet test	Wet test meter	Record calibration factor	Prior to test	
3. Gas meter temperature	Compare to mercury-in-glass thermometer	ASTM Thermometer	15°F	Prior to test	RH5
4. Stack temperature sensor	Compare to mercury-in-glass thermometer	ASTM Thermometer	± 1.5%	Prior to test	RH5
5. Final impinger temperature sensor	Compare to mercury-in-glass thermometer	ASTM Thermometer	15°F	Prior to test	---
6. Filter temperature sensor	Compare to mercury-in-glass thermometer	ASTM Thermometer	± 5°F	Prior to test	RH5
7. Aneroid barometer	Compare to mercury barometer	Mercury column barometer	± 2.5	Prior to test	RH5
8. S-type pitot tube	Design/wind tunnel	Design/standard pitot	Meets RH2 criteria	Prior to test	RH2

[a] Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III: Stationary Source Specific Methods.

SECTION 7.0A   ANALYTICAL PROCEDURES - OPERATION & SAMPLING

No analyses are required for measuring combustion temperature, fuel feed
rates, or samples that will be collected. All are direct readings from
instruments or measurements and therefore analytical procedures need not be
addressed.

The stack gas concentrations are determined by a microprocessor which
generates printouts of all analytical results. A detailed description is
contained in Section II of the trial burn plan. An ORSAT-type device will
be used to determine instantaneous CO, CO2 and O2 measurements on the stack.

SECTION 8.0A DATA REDUCTION, VALIDATION, AND REPORTING

8.1A Data Reduction

Versar will summarize all intermediate calculations and values used in
obtaining all samples in a report which will be given to EG&G. EG&G will
be responsible for all data reduction, validation, and reporting of
analytical results as described in the Trial Burn Plan.

All continuous monitoring data, including calibrations, will be recorded on
ENSCO's strip chart recorders. The data will also be logged directly into
ENSCO's on-line computer. The computer records the readings on a hard disk
with a diskette backup.

The combustion parameters and source sampling data will be reported to the
EG&G Project Manager, who will calculate destruction and removal
efficiencies (DRE) for the contaminants fed to the incinerator. The DRE
for any material is mathmatically defined as follows:

$$DRE\ (\%) = \frac{\text{Waste in} - \text{Waste out}}{\text{Waste in}} \times 100$$

where:

Waste in   = mass feed rate of the contaminant in the feedstock

Waste out = mass emission rate of the contaminant present in the
              incinerator stack discharge

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The amount of HCl in the stack gases will be analytically determined based on total chlorides (from the M5 stack test) and reported in mg/kg. Because of the low chloride load on the system, 3000 ppm HCE and TCB respectively, it is impossible to exceed the EPA limit of 4 pounds of chlorine per hour.

8.2A Data Validation

The principal criteria that will be used to validate the integrity of the gaseous data emissions measured by the continuous monitors will be discrete analyses using ORSAT-type measurements which will be taken directly at the stack. These values will be correlated with the gaseous emissions readings and any discrepencies will be recorded.

The principal criteria that will be used to validate the integrity of the stack field data which is essential to calculate emission levels (POHC, particulate, HCl) will be the following:

(1) Examination of all field data forms by the Quality Assurance Officer.

(2) Verification of calculations for one test run by an independent, second reviewer.

(3) Reporting of all associated blanks, standards, and calibration data along with reported results.

8.3A Data Reporting

The microprocessor which records all system operating parameters on a
periodic basis will be provided to the EG&G project manager in tabular form
along with a floppy diskette which contains the original data. As
appropriate, calibration checks will be recorded on the daily operators
log, and a copy of that log will also be provided.

Data collected as part of the stack sampling effort is maintained on a
portable computer and a tabular printout of these results will be provided
to the EG&G project manager after all tests have been completed.

Copies of the sample chain of custody will be provided to the EG&G project
manager after all samples have been shipped to the laboratory.

9.0A INTERNAL QUALITY CONTROL

Calibration checks for combustion parameters will be performed as described
in Section II of the trial burn report. The operators will perform these
checks with standards of known concentrations. The following paragraphs
briefly explain the sampling control checks.

9.1A Reagent Blanks

Reagent blanks of acetone, methanol, and methylene chloride representing
the probe rinsing media will be tested for solids. Since a field blank is
used, reagent blanks of acetone, methanol, methylene chloride, NaOH, XAD-2,
and filters will be retained and analyzed for POHC's only if a problem with
a particular sample occurs. However, one filter from each lot and aliquot
of XAD from each extracted batch will each be screened for contamination
prior to use.

9.2A Field Blanks

At least one field blank for the MM5 train will be provided for analysis as
per the analytical quality control plan (see Section 9.0B).

9.3A Calibration Standards

The Orsat-type analyzer will be checked by measuring the oxygen content of
ambient air.

9.4A Triplicates

Triplicate stack gas emission samples will be obtained when the incinerator
is operating at soil field rates of four and five tons per hour.

10.0A   QUALITY ASSURANCE AUDITS

10.1A   Field Programs System Audit

After sampling is completed, the Field Programs QCC will inspect
calibration and maintenance records, field data forms and records, and the
calculation of results. EG&G will review actual laboratory practices
during sample analysis. Deviations from protocol and all results of the
audit will be reported to the QAM.

10.2A   QAM Audits

The QAM will verify that all applicable QA/QC procedures are followed,
including (1) calibration and maintenance of equipment, (2) staff
credentials and/or supervision, (3) documentation practices, (4) data
traceability, and (5) sample and document controls. The QAM will also
review QC data and QCC inspections and audits. The results of all
inspections and audits will be summarized and reported, along with any
corrective action requests, to project and EG&G management.

11.0A PREVENTIVE MAINTENANCE

The incinerator operating logs and the monitoring equipment operating logs
will be used for early identification of potential problems that may
require correction during an operating period. Normal equipment inspection
and maintenance will be performed between test operating periods according
to the equipment manufacturer's recommendations.

Maintenance of the equipment for soil and water sampling is limited to
inspection and cleaning prior to each use. Other sampling equipment is
checked prior to each use with appropriate check standards; equipment which
is found to be defective is repaired or replaced immediately.

To minimize any potential sampling delays associated with stack gas
testing, Versar will use six separate sets of MM5 glassware, plus a
redundant train which can be used to replace broken parts. In addition,
two monorails will be used to expedite changing the probe from one side of
the stack to the other.

12.0A SPECIFIC ASSESSMENT PROCEDURES

12.1A Precision

For data sets with a small number of points (n between 2 and 8), the estimate of precision will be expressed as range percent (R%):

$$R\% = \frac{C_1 - C_2}{\bar{C}} \times 100 \qquad (12\text{-}1)$$

where:

C_1 = highest value determined

C_2 = lowest value determined

$\bar{C}$ = mean value of the set

and

$$\bar{C} = \sum_{i=1}^{n} \frac{C_i}{n} \qquad (12\text{-}2)$$

where:

C_1 = ith determination

n = number of determinations

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For one or two values below detection limit (BDL):

BDL = DL/2; where DL = detection limit.

For large data sets (n > 3), the estimate of precision will be expressed
as percent relative standard deviation (%RSD):

$$SD = \frac{\sum_{i=1}^{n} (C_i - C)^2}{n-1} \qquad (12\text{-}3)$$

$$\%RSD = \frac{100\% \times SD}{\overline{C}} \qquad (12\text{-}4)$$

The following paragraphs briefly describe how precision will be determined
for each measurement parameter.

12.1.1A POHC in Feedstock Matrix

For each feedstock matrix sample set analyzed in triplicate, the precision
(R%) for each analyte will be calculated using EQ. 12-1. Then, for each
analyte, the arithmetic mean of all the precision values of the individual
sample sets will be calculated and reported as the overall precision.
Three sample sets should be available for calculating precision.

12.1.2A POHC in Treated Solid Residue

Same as 12.1.1A.

12.1.3A POHC in Stack Emissions

The MM5 field samples will be analyzed in triplicate.

12.1.4A Gaseous Emissions (CO, CO_2, O_2)

For each instrument, an estimate of precision will be calculated from the
high span measurements. All values of the span gas measured before,
during, and after each run over the entire period will be used to calculate
precision. Equations 12-3 and 12-4 will be used for calculating the
precision; a minimum of 12 measurement values for each monitor are expected.

12.2A Accuracy

Accuracy will be determined from the performance samples (i.e., standards
supplied as blind audits by the QCC and the independent laboratory) as
percent accuracy (A%). Accuracy will be determined as percent recovery
(R%) of native analytes from samples spiked with native analytes prior to
sample preparation. The formulas are given below.

For performance samples

$$A\% = \sum_{i=1}^{n} \frac{\text{Amount found}}{\text{True value}}_i \times \frac{100}{n} \tag{12-5}$$

For samples spiked with native analyte

$$R\% = \sum_{i=1}^{n} \frac{\text{Amount found} - \text{native amount prior to spiking}}{\text{Amount spiked}}_i \times \frac{100}{n} \tag{12-6}$$

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12.2.1A Method for POHC

The accuracy of the instrumental procedure will be estimated from the
performance samples supplied by EG&G. Accuracy will be calculated
according to Eq. 12-5. At least one performance sample will be analyzed.

12.2.2A POHC in Feedstock Matrix

Overall accuracy of the contractor's analytical procedures for determining
POHC in ash samples will be assessed by performance on a feedstock solids
audit sample provided by an independent laboratory. The performance sample
will be analyzed at least once and accuracy will be calculated using Eq.
12-5.

12.2.3A POHC in Treated Solid Residue

Same as 12.2.2A.

12.2.4A POHC in Stack Emissions

Accuracy will be assessed as percent recovery of native analyte spiked onto
the sorbent media (XAD) and filters. The estimate of accuracy will be
calculated according to Eq. 12-6. At least two sorbent resin modules and
at least two filters should be spiked in this manner.

12.2.5A Particulate, Cl in Stack Emissions

Accuracy will not be assessed.

12.2.5A Gaseous Emissions (CO, CO2, O2)

For each instrument, accuracy will be determined from measurement of the
zero, mid, and high span cylinder gases. All measured values of the zero,
mid-level, and high-level span gas will be used to calculate instrument
accuracy according to Eq. 12-5. A minimum of 24 measurement values for
each monitor are expected.

13.0A CORRECTIVE ACTION

Sampling data problems will immediately be brought to the attention of the Task Leader. If the Task Leader discovers or is notified of sampling data problems, he will review the severity of the problem and take the appropriate action:

o <u>Minimal data loss</u>: The problem and corrective action taken will be documented; no further action is necessary.

o <u>Moderate data loss</u>: A problem memo will be prepared and sent to the QCC, QAM, and Project Leader; a collective decision on the appropriate action will then be made.

o <u>Severe data loss</u>: A problem memo shall be prepared and sent to the QCC, the Project Leader, EG&G, and the QAM. The USAF Project Manager will be consulted before a collective decision on the appropriate action is made.

The Task Leader implements the corrective action, documents the problem and action taken, then prepares and sends a problem/action-taken memo to the QCC, and QAM, the Project Leader, and EG&G.

If, in any case, sampling data is lost, the Task Leader will investigate the problem, then perform one or more of the following actions:

o If the problem is limited in scope, the problem/action-taken is documented, the Task Leader then prepares and sends a problem/action-taken memo to the QAM, the Project Leader, and EG&G.

o   If a large quantity of data are affected, the
     problem/action-taken memo is sent to the QAM, the Project Leader,
     EG&G, and the USAF Project Officer.

In general, if QA problems are encountered, The Task Leader shall identify
technical problems and:

o   Prepare and send a problem memo to the QAM, the Project Leader,
     and EG&G; if the problems are significant, the action is
     determined collectively.

o   The action taken is documented.

14.0A QUALITY ASSURANCE REPORTS TO MANAGEMENT

The QAM, in cooperation with the Project Leader, Analytical Task Leader, and Field Sampling Task Leader will identify critical areas of the project which will be subject to inspection; the inspection will include a review, where applicable, of:

o   Staff qualifications

o   Sampling equipment calibration and maintenance records

o   Performance audits

o   Systems audits

o   Sample control

o   Document control

o   Sampling data entry, including error handling, corrections, and additions

o   Sampling data traceability and completeness

o   Sampling data calculation and validation

o   Internal QC data

o   External QA data

o   Assessment of sampling data accuracy, precision, and completeness.

The results of inspections/audits will be reported by the QAM to the Project Leader and EG&G management; summaries will be included in the final report.

PART B--ANALYTICAL

3.08 QUALITY ASSURANCE OBJECTIVE--ANALYTICAL

The overall measurement objective is to determine, for each of the
hazardous feed materials selected for testing, the effectiveness of the
mobile incineration facility in achieving thermal
destruction/detoxification of contaminated soil and liquids.

3.1B Precision

Precision is defined in QAMS-005-80[a] as a measure of mutual agreement
among individual measurements of the sample property. For this project,
the QA objectives for precision are expressed in terms of the following
parameters:

3.1.1B Analysis of Standards

One of the QA objectives for this project is that the percent relative
standard deviation (% RSD) of response factors from the initial calibration
curve for the POHC's should be less than 30%. For each subsequent
calibration check, the percent difference (% D) between the mean response
factor from the calibration curve and the response factor from the daily
calibration should be less than 30%.

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a. QAMS-005/80, "Interim Guidelines and Specifications for Preparing
Quality Assurance Project Plans," Office of Monitoring Systems and Quality
Assurance Office of Research and Development, US EPA, Washington, DC 20460,
December 29, 1980.

3.1.2B Analysis of Surrogates

Another QA objective for this project is that the percent recovery for analysis of surrogate compounds in samples from a given waste stream be within the limits specified in the referenced methods.

3.1.3B Analysis of Replicate Samples

A final QA objective is that the results of directed analysis of laboratory replicate samples (i.e., replicate samples drawn from the same field composite sample) be within the limits specified in TableIII.B.1, when at least three replicate samples are analyzed. At least 10% of all analyses performed will be duplicate QA checks.

3.2B Accuracy

Accuracy is defined in QAMS-005/80[a] as the degree of agreement of a measurement or average of measurements with an accepted reference or true value. In general, the accuracy goals for this project are to use reference materials of highest known purity for calibrations and spiking so that determinate errors due to instrument response and incomplete preparation recoveries can be identified and so that any primary uncertainties in the analytical data will be due to random errors not exceeding those in Table 3B.1.

Each instrument used in this project will be checked on each day that samples are analyzed to demonstrate performance. One of the QA objectives is that the absolute instrument response [e.g., area counts per ng injected for the internal standard(s) and/or surrogates in a GC/MS analysis] are within a factor of 2 (-50% to +100%) of the value of the last daily standard.

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3.38 Completeness

The QA objective for this program is to obtain valid analytical results for
at least 95% of the samples collected during this program. Results outside
of QA limits may be cuased by sample matrix. Matrix effects will be
confirmed by reanalysis when possible.

3.48 Representativeness

The following factors are addressed in the Trial Burn Plan to ensure the
best possible representative sample: sampling sites, process cycles, catch
flow rates (sampling frequency), sample preservation, and sampling
procedures and equipment.

3.58 Comparability

All data will be reported in mg, µg, or ng of analyte per kilogram,
liter, or cubic meter of original sample.

TABLE III.B.1 QUALITY ASSURANCE OBJECTIVES FOR PRECISION, ACCURACY AND COMPLETENESS

Analysis	Measurement Type	Matrix	Reference	Method Precision[b]	Method Accuracy[c]	Completeness
TCB	GC/MS	2,3,4	SW-846-3270	28.1	44-142%	95%
HCE	GC/MS	2,3,4	SW-846-3270	24.5	4-113%	95%
HCl	Titrimetric	1	EPA 325.3	<10		95
Particulate emissions	Gravimetric	1		<10		95

a. Matrix code
   1 - EPA Method 5 train
   2 - MM5 train
   3 - Scrubber water
   4 - Soils

b. Expressed as standard deviation in µg/L.

c. Expressed as percent recovery.

d. Detected, result must be greater than zero.

4.08   SAMPLING PROCEDURES--ANALYTICAL

The analytical methods to be used for the sample analysis are referenced in Table III.E.3.1 in the Trial Burn Plan.

5.08   SAMPLE CUSTODY--ANALYTICAL

An essential part of any sampling/analytical scheme is ensuring the
integrity of the sample from collection to data reporting. This includes
the ability to trace the possession and handling of samples from the time
of collection through analysis and final disposition. The sample custody
procedures to be used for this program conform to the guidelines of
SW-846. The trial burn sampling manager will be responsible for sample
custody in the field. The laboratory project manager will be responsible
for the sample custody at the laboratory.

5.18 Laboratory Custody Procedures

The laboratory QC and project manager will immediately acknowledge receipt
of samples in writing, and will verify that the information on the sample
tags matches the information in the chain-of-custody records. Each sample
will be logged in by an assigned laboratory identification number, and
every sample will have a unique, non-recurring laboratory number. The log
notebook will include the field number, date of receipt, condition of
sample when received, qualitative description, assigned laboratory number,
sample preparation (spiking, etc.), sample distribution, and any other
information deemed appropriate. The respective laboratory QC and project
manager will be responsible for preparing and introducing control samples,
blanks, and check standards.

Samples will be kept in refrigerated storage when not being analyzed.
Sample distribution sheets will also accompany the samples. The sample
custodian will be responsible for preparing the sheets.

The analyst will be responsible for samples during analysis and for logging
laboratory analysis information.

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5.2B SAMPLE RETENTION

Samples must be retained by the analytical laboratory until written
instructions for disposal are issued by the trial burn project manager.

6.0B   CALIBRATION PROCEDURES AND FREQUENCY--ANALYTICAL

6.1B   STACK SAMPLING

Calibration of the equipment is the responsibility of the sampling
subcontractor.   Calibration of stack sampling equipment will be performed
within 2 weeks before initiation of field sampling.   The procedures will
conform to the specifications of the EPA document, "Quality Assurance
Handbook for Air Pollution Measurement Systems," Volume III, Stationary
Source Specific Methods (von Lehmden et al., EPA-600/4-77-027b,
January 1930).   Dry gas meters, nozzles, orifices, and pitot tubes will be
included in the calibrations.

6.2B   Analytes

6.2.1B   Before analysis of each set of samples and on a daily basis during
the analysis, the instruments will be turned and calibrated.

7.08 ANALYTICAL PROCEDURES--ANALYTICAL

The analytical methods to be used in this program are given in the Trial
Burn Plan and are included here for reference.

7.1 Method   SW-846-3510   Separatory Funnel Liquid-Liquid Extraction

7.2 Method   SW-846-3540   Soxhlet Extraction

7.3 Method   SW-846-3550   Sonication Extraction

7.4 Method   SW-846-8270   GC/MS Method for Semivolatile Organics:
                             Capillary Column Technique

7.5 Method   EPA 325.3   Titrametric, Mercuric Nitrate

8.08   DATA REDUCTION, VALIDATION, AND REPORTING--ANALYTICAL

8.18   Data Reduction

The analytical laboratory will specify its data reduction methods. A deliverable checklist will be filled out during data review to ensure completeness of data.

8.28   Data Validation

The principal criteria that will be used to validate the integrity of data during collection and reporting are:

o   Verifying, on a weekly basis, by the project analyst that all raw data generated in the preceding week have been stored on magnetic tape and on hard copy and that storage locations have been documented in the laboratory records.

o   Examining of all of the data by the analytical QA/QC coordinator to verify adequacy of documentation, and confirm that peak shape, resolution, and calculations of response factors of shift standards match calibration curves.

o   Confirming that raw areas for internal standards and calibration standards and raw and relative areas for surrogate compounds are within the expected values.

o   Reporting of all associated blank, standard, and QC data along with results for analysis of each batch of samples is performed.

o   Reporting of all analytical data for samples with no values
     rejected as outliers, because of the small number of replicate
     samples for analysis.

8.3B Reporting

All results will be reported to the trial burn project manager by sample
batches and will be certified.

All reports and documentation required, including chromatograms and mass
spectra, calibration summaries, QC results, shall be clearly labeled with
the sample number and associated sample/traffic report number.

9.08   INTERNAL QUALITY CONTROL CHECKS--ANALYTICAL

Overall effectiveness of a quality control program depends upon operating
the laboratory in accordance with a program which systematically assures
the precision and accuracy of analyses by detecting errors and preventing
their recurrence or measuring the degree of error inherent in the methods
applied.

The routine internal quality control program of the analytical laboratory
will include daily calibration of instruments using certified standards.
Glassware is checked for cleanliness and for detergent removal prior to
each analysis run. Pesticide quality solvents are used for trace organic
applications. Each lot of solvent is checked to assure its suitability for
the intended analysis. The highest commercially available purity standards
are used for calibration.

The analytical laboratory's QA/QC plan gives guidelines for number and
frequency of replicate and spiked QC samples and calibration standards to
be used in the project, including identity and concentration of surrogate
spike compounds to be added to each designated sample.

The blank, analytical replicate, and spiked quality control samples will be
analyzed in the same way as field samples and interspersed with the field
samples. The analytical results of these samples will be used to document
the validity and control the quality of data within predetermined tolerance
limits.

10.0B PERFORMANCE AND SYSTEM AUDITS--ANALYTICAL

A system audit of the analytical laboratory will be made and reported by
the project manager before the implementation of any analytical
procedures. During the course of this audit the project manager will
remain sensitive to the possible need for additional review of the program,
and will suggest the inclusion of other appropriate personnel in the audit
process if necessary.

Because of the anticipated difficulty in obtaining reference samples with
matrices similar to the waste samples to be analyzed, performance audits
will rely heavily on split real samples, spiked and unspiked, and sample
blanks up to a maximum of 10% of the samples submitted for analysis.

11.0B PREVENTIVE MAINTENANCE--ANALYTICAL

The hardware associated with the analyses, such as the GC/MS system, should have regularly scheduled preventive maintenance. Chromatographic carrier gas purification traps and injector septa should be replaced on a regular basis. The pump seals should also be replaced regularly depending on the types of solvents employed.

Most maintenance, however, such as column replacement, source cleaning, filament replacement, etc., must be performed on an as-needed basis when performance begins to degrade as evidenced by degradation of peak resolution, decreased ion sensitivity, shift in calibration curves, or failure to meet the QC check criteria.

Adequate supplies of spares including GC columns, septa, syringes, and MS filaments should be maintained so that they are available when needed.

12.08   SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.18   Calculation of Mean Values and Estimates of Precision

The mean, C, of a series of replicate measurements of concentration, C_i, for a given surrogate compound or analyte will be calculated as:

$$C = \frac{1}{n} \sum_{i=1}^{n} Ci$$

where:

n   =   number of replicate measurements; C, C_i are both in mg/L or mg/kg.

The estimate of precision of a series of replicate measurements will usually be expressed as the relative standard deviation, RSD:

$$RSD = \frac{SD}{C} \times 100\%$$

where:

SD   =   standard deviation

$$SD = \sqrt{\frac{\sum_{i=1}^{n} (Ci-C)^2}{(n-1)}}$$

Alternatively, for the data sets with a small number of points (e.g., concentration of pesticide in duplicate samples of one waste stream) the estimate of precision may be expressed as a range per cent, R:

$$R = \frac{C_1 - C_2}{C} \times 100\%$$

where:

C_1 = highest concentration value measured in data set, and

C_2 = lowest concentration value measured in data set.

The standard deviations calculated will be compared on a weekly basis with the respective goals.

12.2B Assessment of Accuracy

Accuracy will be evaluated by comparing the mean recovery of surrogate compounds. The recovery of a surrogate compound will be defined as:

$$\text{Recovery} \% = \frac{C_s \times V_s \text{ (or } W_s)}{Q_s} \times 100$$

where:

C_s = measured concentration of surrogate compound in sample, mg/L (or mg/kg),

V_s or W_s = total volume (or weight) of sample to which surrogate was added, L (or kg), and

Q_s = quantity of surrogate compound added to sample, mg.

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12.3B Procedure for Assessment of Spike Accuracy

The accuracy of a spiked compound will be defined as:

$$\text{Accuracy \%} = \frac{C_t}{C_s + C_b} \times 100$$

where:

C_t = total measured concentration found in spiked sample or blank,

C_b = measured concentration found in sample or blank, and

C_s = measured concentration spiked into sample or blank.

NOTE: All measurements are in the same concentration units.

12.4B Instrumental Control Chart Generation From Check Standard
or Check Sample

Control charts will be generated from check standards run every eight hours.

12.5B Completeness

Completeness will be expressed as the percentage of the total data that meet the QA guidelines.

13.08 CORRECTIVE ACTION--ANALYTICAL

For each analytical method employed, precision and accuracy will regularly be tracked by computing the standard deviation or range of the results of replicate analyses. Periodic determinations of recovery of the surrogates will be made. The mean recovery and the standard deviation of the replicate set will be computed. These data will be accumulated for each kind of sample matrix analyzed, e.g., solid, aqueous, liquid, ash. These statistics will be updated from lot to lot as additional analyses are performed and more experience is gained. When either the standard deviation of replicate results, the average recovery, or the relative standard deviation of replicate recoveries exceeds twice the most recently updated actual values for those statistics or the performance goals, whichever is more stringent, corrective action will be taken to improve performance before analyzing the next lot.

If, during system or performance audits, weaknesses or problems are uncovered, corrective action will be initiated immediately. Corrective action will include, but not necessarily be limited to: recalibration of instruments using freshly prepared calibration standards; replacement of lots of solvent or other reagents that give unacceptable blank values; additional training of laboratory personnel in correct implementation of sample preparation and analysis methods; and reassignment of personnel, if necessary, to improve the overlap between operator skills and method requirements.

Whenever a long-term corrective action is necessary to eliminate the cause of nonconformance, the following closed-loop corrective action system will be used by the respective analytical laboratories;

    o   Problem will be defined

o   Responsibility for investigating problem will be assigned

o   Cause of the problem will be investigated and determined

o   Corrective action to eliminate the problem will be determined

o   Responsibility for implementing corrective action will be
     assigned and accepted

o   correction implemented and effectiveness of the corrective action
     will be established

o   The fact that the corrective action has eliminated the problem
     will be verified

14.08   QUALITY ASSURANCE REPORTS--ANALYTICAL

14.18   Quality Assurance Reports to Laboratory Management

The analytical laboratory's QA/QC plans will specify the appropriate personnel who will meet on a regular basis to assure that all QA/QC practices are being carried out and will review possible or potential problem areas. It is important that all data anomalies be investigated to assure that they are not a result of operator or instrument deviation but are a true reflection of the methodology or task function.

The laboratory quality control manager documents the results of blind spikes and performance standards in a central logbook which is reviewed periodically.

14.28   Quality Assurance Reports to the Trial Burn Project Manager

The certified analyses reports to the trial burn project manager will contain a section or statement that covers the data quality and validity. The following information will be covered where appropriate:

- o   Assessment of measurement data precision, accuracy, and completeness

- o   Performance audit results

- o   System audit results

- o   Significant QA problems and recommended solutions

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APPENDIX C

CLEAN SAND FEED RATE DATA FOR
MWP-2000 INCINERATOR SYSTEM TRIAL BURN AT NCBC

Appendix C contains the raw feed rate data collected from the weigh hopper load cells. This appendix was reproduced from the best available copy.

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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WEIGH HOPPER DATA SHEET

DATE: 5-11-87   NCBC H.O. Site

TIME	INITIAL WT.	FINAL WT	NET WEIGHT
5²⁰ ᴀᴍ	0	8590	8590
6⁰⁵	760/835	6240/6305	5480 ₆₄₇₀
7²⁰	410/580	5170/5240	4760 ₆₇₀, 4673 4.6
7⁴²	540/625	6100/6160	·5560 ₅₅₇₅ ₅₇₄) 4.0
8¹⁵	760/895	5770/5835	5010/4940 5080 4.3
8⁴⁷	690/780	5950/6020	5260/5140 5410 5.4
9¹⁶	⁻540/630	5640/5705	5100/5075 4970 4.2
9⁴¹	670/755 ·	5940/6005	5270/5250 5130 5.14
10²⁸	750	5900	5150 5265 4.2
10⁵³	535	5270	4735 ·4890 5.6
11¹⁸	380	5730	5350 4940 5.4
11⁴⁵	790	5810	5620 4035 6.1
12¹⁰	680	5770	5090 4890 4.9
12⁴⁰	780	5970	5190 5270 4.1
1¹⁵	620	5240	4620 4840 5.8
1⁴⁴	800	5790	4990 5415 3.1
2¹⁵	325		

* FIRST VALUE IS ON SCALE FACE, SECOND VALUE IS REMOTE.

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pg. #2

WEIGH HOPPER DATA SHEET   NCBC H.O. Site

DATE: 5-11-87

TIME	INITIAL WT.	FINAL WT	NET WEIGHT		
2¹⁶	325	4570	4245	4040	4.6
				7058	5.4
2⁴²	.530	5400	4870	520	5.3
3¹¹	190	5170	4980	4770	5.96
3³⁶	200	4970	4770	4690	4.5
				4502	
4⁰⁵	280	3230	2950		
				5.43	

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NCBC TRIAL BURN

RUN 7A   SAND FEEDRATE CALCULATION

TIME	INTERVAL (MIN)	INITIAL (LBS)	FINAL (LBS)	NET (LBS)	AVERAGE FEEDRATE (TPH)		
05:00 AM		0	8590				
06:05 AM	65	760	6240	7830	3.61		
07:20 AM	75	410	5170	5930	2.33		
07:40 AM	20	540	6100	4630	6.95		
08:15 AM	35	760	5770	5340	4.58	MMS START 8:15 AM	
08:47 AM	32	690	5950	5080	4.76		
09:16 AM	29	540	5640	5410	5.60	RUN TIME:	416
09:48 AM	32	670	5940	4970	4.66	RUN MASS:	70470
10:18 AM	30	750	5900	5190	5.19	RUN AVG:	5.08
10:52 AM	34	535	5270	5365	4.73		
11:18 AM	26	380	5730	4890	5.64	RUN MAX:	6.16
11:45 AM	27	790	5810	4940	5.49	RUN MIN:	4.59
12:10 PM	25	680	5770	5130	6.16		
12:40 PM	30	730	5970	4990	4.99		
01:15 PM	35	520	5240	5350	4.59		
01:44 PM	29	900	5790	4440	4.59		
02:16 PM	32	325	4570	5463	5.12		
02:42 PM	26	530	5400	4040	4.66		
03:11 PM	29	190	5170	5210	5.39	MMS END 3:15 PM	
03:36 PM	25	200	4970	4970	5.96		
04:05 PM	29	280	3230	4670	4.85		

             565   103760

                    DAILY AVERAGE   4.68

                    DAILY MAX: 6.95
                    DAILY MIN: 2.33

SAND FEED RATE CALCULATION

RUN 7A.

EQUATION:

$$\frac{SAND \ IN_{(NET)}}{INTERVAL}$$

GIVEN:

TIME	BEFORE*	AFTER*
6:05	750	6240
7:20	410	5170

* REFERS TO "BEFORE" AND "AFTER" WEIGH HOPPER
   IS LOADED

SAND IN$_{(NET)}$

$$SAND \ IN_{(NET)} = AFTER_{6:05} - BEFORE_{7:20}$$

$$= 6240 - 410$$

$$= 5830 \ \# \qquad = 2.915 \ Tons.$$

INTERVAL

$$INTERVAL = 7:20 - 6:05$$

$$= 75 \ min \qquad = 1.25 \ hrs.$$

FEEDRATE

$$FEEDRATE = \frac{2.915}{1.25} = 2.332 \ tph.$$

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WEIGH HOPPER DATA SHEET

DATE: 5-12-87 NCBC H.O. Site

TIME	INITIAL WT.	FINAL WT	NET WEIGHT	
0643	0	8560	8560	
0735	950* / 940	4890/4820	3940/3880	
0755	970 / 970	4780/4715	3810/3745	3620 10 5.4.7
0815	1160 / 1155	4720/4650	3560/3595	3920 10
0835	800 / 790	4360/4300	3560/3510	3850 23
0858	510 / 510	4460/4395	3950/3885	4070 24
0927	390 / 400	4270/4215	3880/3815	3560 22
0949	730 / 730	4640/4575	3910/3845	
1011	670 / 670	4800/4735	4130 / 4065	
1035	630 / 635	4850/4785	4220 / 4150	
1059	900 / 895	4910/4845	4010 / 3950	
1123	430 / 430	4730/4665	4300 / 4235	
1146	500 / 495	4210/4150	3710 / 3655	
1207	370 / 375	4220/4170	3850 / 3795	
1222	500 / 500	4200/4240	3700 / 3740	
1245	410 / 415	3900/3905		

* FIRST VALUE IS SCALE FACE, SECOND IS REMOTE (CONTROL ROOM.)

WEIGH HOPPER DATA SHEET

DATE: _5-12-87_ N.C.B.C. H.O. Site

TIME	INITIAL WT.	FINAL WT	NET WEIGHT
1300	750 /745	4390/4330	3640/3585
1325	720 /795	4850/4780	4130/3985
1350	1390/1400	5560/5510	4170/4110
1421	320 /350	3130/3085	2810/2735
1433	920 /925	3775/3735	
THAT'S ALL		FOLKS	
1456 end	Ø 0		

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WEIGH HOPPER DATA SHEET

DATE: _5-16-87_ NCBC H.O. Site

TIME	INITIAL WT.	FINAL WT	NET WEIGHT
0500	- 0 -/-0-	9270/9130	
6 26 AM	830 - 820	4340/4700	
6 45 AM	530 - 575	4560/4430	
7 16 AM	680 - 680	465/4430	
7 38 AM	875 - 880	485/4945	
7 56 AM	895 - 900	4480/5050	...50-...70 = ...70
8 ... AM	480 - 280	54/5420	...
8 41	430 - 500	4470 - 4410	3510
9 02	580 - 585	4800 - 4735	4770
9 27	430 - 435	4600 - 4535	4210
9 50	390 - 395	4420 - 4355	4760
10 12	360 - 360	4320 - 4255	...
10 37	280 - 280	4340 - 4280	...
11 05 AM	25 - 20	4140 - 3880 ?	...
11 20 AM	610 - 625	4960 - 4785	...
11 41 AM	815 - 820	4725 - 4790	...

Pg. #2

DATE: 5-16-87 NCBC H.O. Site

TIME	INITIAL WT.	FINAL WT	NET WEIGHT
12 $\frac{46}{PM}$	220-225	4590-4525	4230
12 $\frac{30}{PM}$	360-360	4690-4620	
12 $\frac{57}{}$	80 - 90	4200-4140	
1 $\frac{20}{}$	60 - 65	4350-4290	5565
(PRE-MIXED)			
1 $\frac{42}{}$	100 - 110	2770-2735	
1 $\frac{59}{}$	140 - 145	3390 - 3345	
2 $\frac{17}{}$	160 - 160	2850-2810	
2 $\frac{31}{}$	310 - 325	3510-3465	
2 $\frac{45}{}$	160 - 150	5760 -5660	
3 $\frac{16}{}$	200 - 210	5520 -5440	
3 $\frac{46}{}$	260-260	6290 -6175	
* 4 $\frac{30}{PM}$	* 20 - 20	3700 -3750	

20 #/ Contaminated

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APPENDIX D

DETAILED INCINERATOR PROCESS OPERATING
DATA FROM NCBC TRIAL BURNS

Exhibit 1   Schematic Flow diagram showing process points

Exhibit 2   Tabulated Data

The documents contained in this appendix were published according to
their own internal style, which deviates from the Air Force
Engineering Services Center format. They have, therefore, been
published without editing.

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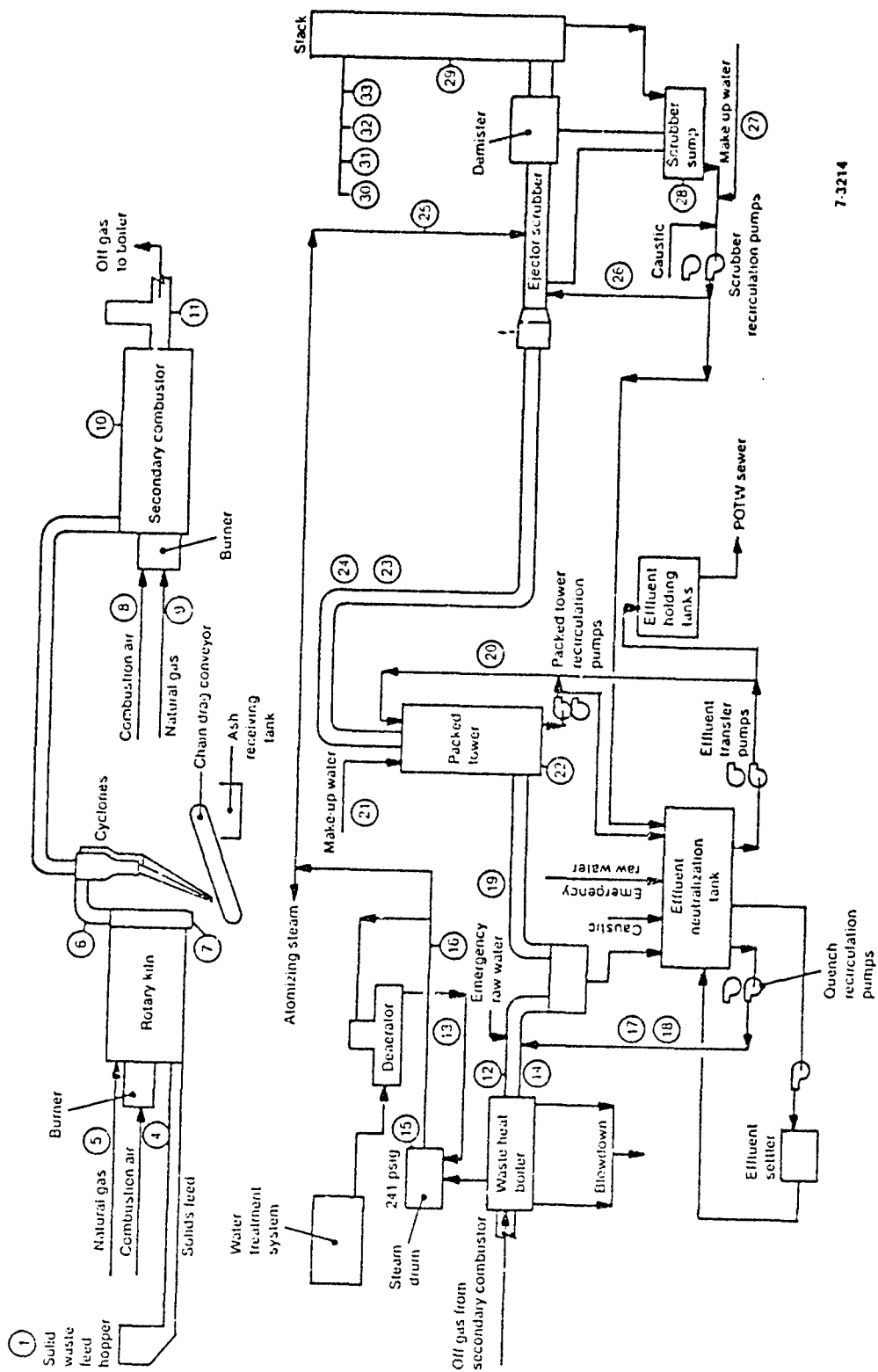
Figure 4-1. Schematic flow of MWP-2000 showing process po'~ts

7-3214

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TABLE 4-1. AVERAGE OPERATING CONDITIONS SUMMARY

Point	Name	Units	05/11/87 Run 7A	05/12/87 Run 7B	05/16/87 Run 7C
	Kiln				
1	Solids feed	Tons/hr	5.1	5.3	5.3
	Auger speed	rpm	5.82	5.80	5.95
4	Combustion air	lb/min	170	181	181
5	Natural gas	scfh	14410	14780	14660
6	Outlet temperature	°F	1455	1457	1462
7	Outlet pressure	in. H_2O	-0.223	-0.277	-0.231
	Secondary combustor				
8	Combustion air	lb/min	293	287	285
9	Natural gas	scfh	23177	23465	23535
10	Outlet temperature	°F	2156	2157	2158
11	Outlet pressure	in. H_2O	-2.36	-2.73	-2.6
	Boiler				
12	Outlet temperature	°F	484	484	490
13	Boiler feed	gpm	39.3	45.0	36.1
14	Outlet pressure	in. H_2O	-8.88	-9.52	-9.35
15	Steam temperature	°F	402	401	408
16	Steam pressure	psig	227	224	241
	Quench				
17	Recirculation	gpm	73.9	75.0	75.2
18	pH		6.0	7.8	7.1
19	Outlet pressure	in. H_2O	Not available	-13.69	-13.84
	Packed tower				
20	Recirculation	gpm	146	128	122.8
21	Fresh make-up	gpm	4.1	5.5	0.1
22	Inlet temperature	°F	171	171	174
23	Outlet temperature	°F	166	167	169
24	Outlet pressure	in. H_2O	-13.40	-19.14	-19.47
	Scrubber				
25	Jet steam pressure	psig	204.4	194	216
26	Recirculation	gpm	37.9	35.6	36.7
27	Fresh make-up	gpm	4.84	3.01	0.1
28	pH		4.1	8.2	8.2
	Stack				
29	Temperature	°F	188	188	190
30	CO	ppm	3.66	3.86	0.52
31	CO_2	%	8.22	8.11	8.44
32	O_2	%	5.82	5.68	5.61
33	Condensate pH		3.7	4.3	4.6
	Calculated values				
	SCC residence time	sec	1.46	1.69	1.69
	Combustion efficiency	%	99.99554	99.99524	99.99950
	MM5 stack velocity	ft/sec	76.27	78.00	79.74
	M5 stack velocity	ft/sec	73.27	74.65	75.29

TABLE 4-2. OPERATING CONDITIONS FOR RUN 7A (05/11/87)

Point	Name	Units	Average	Minimum	Maximum
	Kiln				
1	Solids feed	Tons/hr	5.1	N/A	N/A
4	Combustion air	lb/min	170	157	177
5	Natural gas	scfh	14410	13690	15000
6	Outlet temperature	°F	1455	1431	1479
7	Outlet pressure	in. H_2O	-0.223	-0.114	-0.351
	Auger speed	rpm	-5.82	5.50	6.11
	Secondary combustor				
8	Combustion air	lb/min	293	288	299
9	Natural gas	scfh	23177	22571	23846
10	Outlet temperature	°F	2156	2147	2172
11	Outlet pressure	in. H_2O	-2.36	-1.94	-2.81
	Boiler				
12	Outlet temperature	°F	484	477	492
13	Boiler feed	gpm	39.3	33.5	49.3
14	Outlet pressure	in. H_2O	-8.88	-8.38	-9.29
15	Steam temperature	°F	402	398	410
16	Steam pressure	psig	227	216	248
	Quench				
17	Recirculation	gpm	73.9	68.2	84.1
18	pH		6.0	2.0	10.8
19	Outlet pressure	in. H_2O	Not available	Not available	Not available
	Packed tower				
20	Recirculation	gpm	146	143	148
21	Fresh make-up	gpm	4.1	0.1	9.8
22	Inlet temperature	°F	171	168	208
23	Outlet temperature	°F	166	164	170
24	Outlet pressure	in. H_2O	-13.40	-17.30	-19.00
	Scrubber				
25	Jet steam pressure	psig	204.4	194	215
26	Recirculation	gpm	37.9	36.9	38.7
27	Fresh make-up	gpm	4.84	0.09	9.80
28	pH		4.1	2.8	7.1
	Stack				
29	Temperature	°F	188	187	190
30	CO	ppm	3.66	3.2	4.33
31	CO_2	%	8.22	7.59	8.8
32	O_2	%	5.82	5.2	6.5
33	Condensate pH		3.7	3.1	4.1
	Calculated values				
	SCC residence time	sec	1.46	1.34	1.74
	Combustion efficiency	%	99.99554	99.99466	99.99617
	VMS stack velocity	ft/sec	76.27	76.6	77.9
	MS stack velocity	ft/sec	73.27	76.0	77.9

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TABLE 4-3. OPERATING CONDITIONS FOR RUN 7B (05/12/87)

Point	Name	Units	Average	Minimum	Maximum
	Kiln				
1	Solids feed	Tons/hr	5.3	5.2	5.6
4	Combustion air	lb/min	181	175	189
5	Natural gas	scfh	14780	14450	15000
6	Outlet temperature	°F	1457	1442	1470
7	Outlet pressure	in. H_2O	-0.277	-0.142	-0.390
	Auger speed	rpm	5.80	5.71	5.89
	Secondary combustor				
8	Combustion air	lb/min	287	282	294
9	Natural gas	scfh	23465	22857	24000
10	Outlet temperature	°F	2157	2147	2173
11	Outlet pressure	in. H_2O	-2.73	-2.42	-3.04
	Boiler				
12	Outlet temperature	°F	484	480	490
13	Boiler feed	gpm	45.0	0.2	50.0
14	Outlet pressure	in. H_2O	-9.52	-9.24	-9.76
15	Steam temperature	°F	401	396	407
16	Steam pressure	psig	224	212	239
	Quench				
17	Recirculation	gpm	75.0	69.9	87.5
18	pH		7.8	3.1	10.5
19	Outlet pressure	in. H_2O	-13.69	-13.30	-14.00
	Packed tower				
20	Recirculation	gpm	128	125	145
21	Fresh make-up	gpm	5.5	0.1	9.8
22	Inlet temperature	°F	171	170	173
23	Outlet temperature	°F	167	165	170
24	Outlet pressure	in. H_2O	-19.14	-18.60	-19.60
	Scrubber				
25	Jet steam pressure	psig	194	190	195
26	Recirculation	gpm	35.6	34.8	37.2
27	Fresh make-up	gpm	3.01	0.09	9.76
28	pH		8.2	7.8	8.5
	Stack				
29	Temperature	°F	188	187	190
30	CO	ppm	3.86	3.38	4.27
31	CO_2	%	8.11	7.77	8.90
32	O_2	%	5.68	5.0	6.0
33	Condensate pH		4.3	3.6	4.8
	Calculated values				
	SCC residence time	sec	1.69	1.66	1.70
	Combustion efficiency	%	99.99524	99.99470	99.99532
	MM5 stack velocity	ft/sec	73.00	76.1	78.4
	M5 stack velocity	ft/sec	74.65	72.9	75.9

TABLE 4-4. OPERATING CONDITIONS FOR RUN 7C (05/16/87)

Point	Name	Units	Average	Minimum	Maximum
	Kiln				
1	Solids feed	Tons/hr	5.3	5.1	5.4
4	Combustion air	lb/min	181	177	185
5	Natural gas	scfh	14660	13680	15000
6	Outlet temperature	°F	1462	1448	1477
7	Outlet pressure	in. H_2O	-0.231	-0.116	-0.338
	Auger speed	rpm	5.95	5.88	6.04
	Secondary combustor				
8	Combustion air	lb/min	285	281	290
9	Natural gas	scfh	23535	22989	24000
10	Outlet temperature	°F	2158	2150	2172
11	Outlet pressure	in. H_2O	-2.60	-2.20	-2.96
	Boiler				
12	Outlet temperature	°F	490	484	497
13	Boiler feed	gpm	36.1	0.1	50.0
14	Outlet pressure	in. H_2O	-9.35	-8.72	-9.74
15	Steam temperature	°F	408	402	413
16	Steam pressure	psig	241	224	258
	Quench				
17	Recirculation	gpm	75.2	71.4	80.4
18	pH		7.1	1.9	10.8
19	Outlet pressure	in. H_2O	-13.84	-12.90	-14.20
	Packed tower				
20	Recirculation	gpm	122.8	121.9	123.8
21	Fresh make-up	gpm	0.1	0.1	0.2
22	Inlet temperature	°F	174	172	176
23	Outlet temperature	°F	169	167	171
24	Outlet pressure	in. H_2O	-19.47	-18.45	-20.09
	Scrubber				
25	Jet steam pressure	psig	216	202	231
26	Recirculation	gpm	36.7	35.2	37.5
27	Fresh make-up	gpm	0.1	0.1	0.2
28	pH		8.2	7.6	8.6
	Stack				
29	Temperature	°F	190	188	192
30	CO	ppm	0.52	0.12	Not available
31	CO_2	%	8.44	7.94	9.27
32	O_2	%	5.61	4.90	6.10
33	Condensate pH		4.6	4.0	5.0
	Calculated values				
	SCC residence time	sec	1.69	1.67	1.70
	Combustion efficiency	%	99.99950	99.99993	99.99884
	MM5 stack velocity	ft/sec	79.74	77.8	80.6
	M5 stack velocity	ft/sec	75.29	69.6	76.0

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APPENDIX E

TRANSMITTAL OF RESPONSE TO EPA TECHNICAL ISSUES

Appendix E contains the EPA questions and information requests concerning various technical issues. This appendix was reproduced from the best available copy.

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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INEL
Idaho National Engineering Laboratory

September 2, 1987

Ms. Carone Falconer
EPA Region IV
345 Courtland St, NE
Atlanta, GA 30365

TRANSMITTAL OF RESPONSE TO EPA TECHNICAL ISSUES - DJH-11-87

Dear Ms. Falconer:

Attached for your review and approval is a formal response to Mr. Patrick Tobin's request to Mr. James Van Orman (USAF) for additional information. That request was received by Mr. Van Orman on June 9, 1987. A formal response to Mr. Tobin's letter concerning the trial burn report is currently being prepared and will be sent to you next week.

A duplicate transmittal will be sent to you by Friday, September 4, 1987, via Federal Express. That transmittal will include a certification statement from Major T. L. Stoddart (USAF/RDVW).

As we discussed on Monday, EG&G, the Air Force, and Ensco would like to meet with you and Ms. Betty Willis next week in your Atlanta offices to clarify any outstanding items. I will telephone you later this week to arrange a mutually convenient time.

If you have any questions, please call me at (208) 526-9959.
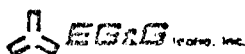
Very truly yours,

Daniel J. Haley
Sr. Program Specialist
Hazardous Waste Programs

br

Attachment:
As Stated

cc: R. Abramo, Ensco
    D. M. Knudson, Ensco
    B. A. Reiter, Ensco
    Maj. T. L. Stoddart, USAF/RDVW
    B. Willis, EPA Region IV
    J. O. Zane, EG&G Idaho (w/o Attach.)

EG&G Idaho, Inc.   P.O. Box 1625   Idaho Falls, ID 83415

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EG&G Idaho, Inc.

Response to

EPA Technical Issues At NCBC

Gulfport, MS

September 2, 1987

1. A revised ambient air monitoring plan to be used during excavation must be submitted. The revised plan should include EPA's comments which are enclosed to this letter. In addition to measures outlines in the enclosure, it is requested that you specify turn-around time for analysis of samples taken during each excavation period. You must also specify procedures to be taken in the event of the samples exceed the action level of 3 pg/m^3.

EG&G Idaho proposes to develop an ambient air monitoring program to measure the concentration of 2,3,7,8-TCDD and Total Suspended Particulates (TSP) at the former Herbicide Orange storage site on the Naval Construction Battalion Center, Gulfport, MS. Although the details of the plan are currently being developed, the basic plan is to collect data using High Volume air samplers and Poly Urethane Foam (PUF) samplers. Both background and routine operation data would be obtained and evaluated continuously throughout the project duration.
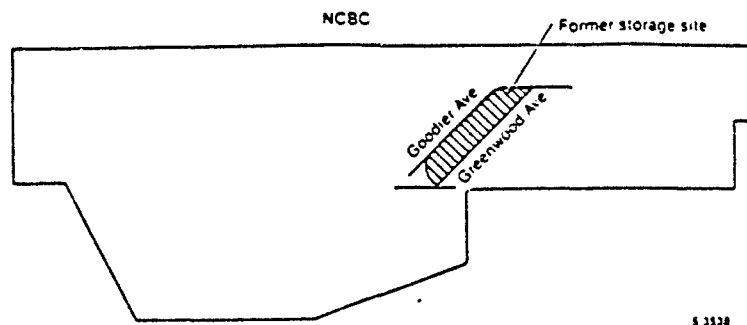
Background Sampling

Background information will be collected by using three PUF samplers located as shown in Figure 1. Each sampler would be run for 24 continuous hours. The sample filters will be changed daily and at least one week of data will be obtained.

Only PUF sampler B would be analyzed initially. If that sampler showed a positive detection of 2,3,7,8-TCDD above 3 pg/m^3, then samplers A and C would also be analyzed. By analyzing the A and C samples following a positive detection, the extent of TCDD contamination and validity of the initial laboratory results could be determined.

In addition to PUF samples, High Volume air samplers will be used to collect total suspended particulate data. The samplers will be run for 24 continuous hours.

The background data collected during this phase will be submitted to the EPA for review. In addition, ambient air data obtained during the December 1986 Verification Tests, and the Equipment Decontamination Project

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NCBC   Former storage site

NCBC perimeter and location of former Herbicide Orange Storage Site.

Wind Direction

On Site
PUF

Downwind
PUF   Greenwood Ave.

Upwind
Goodier Ave.   Onsite   Onsite   PUF
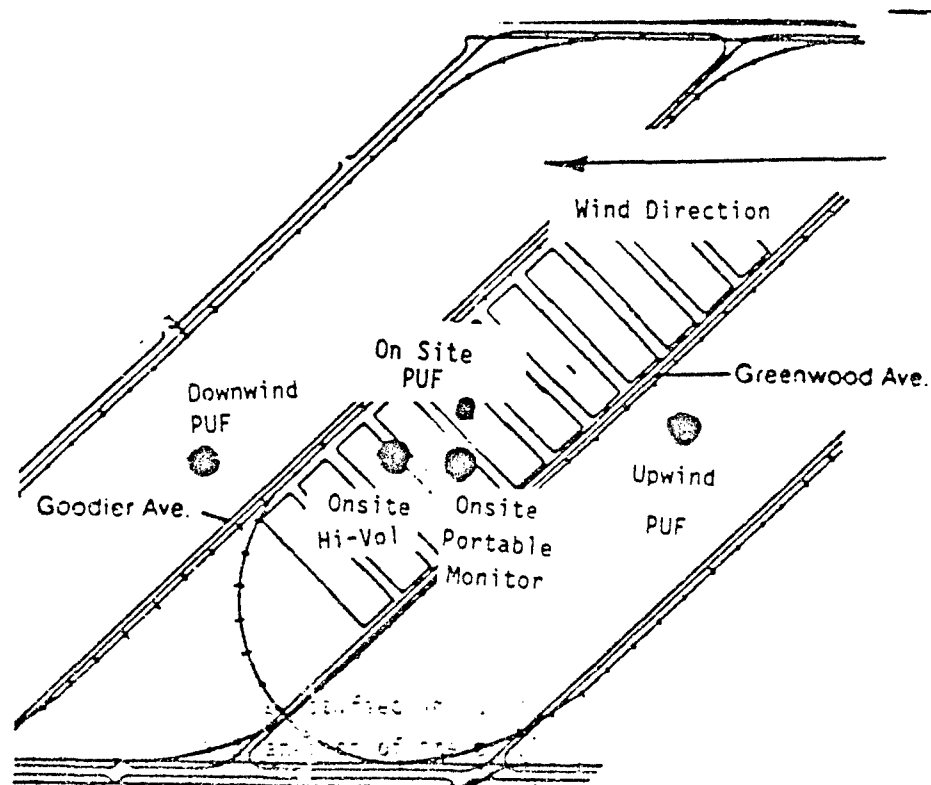   Hi-Vol   Portable
                              Monitor

Figure 1   EXAMPLE SAMPLING LOCATIONS AT NCBC

(Dependent on wind direction)

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conducted in the fall of 1986 will be resubmitted. Currently, it is EG&G's understanding that commencement of routine operations is not contingent upon EPA's review of the background ambient air data.

Initial Routine Operation Sampling

The routine operation sampling phase will begin once approval to commence excavation and routine operations is received from the EPA. During the first 30 days of routine operations, when excavation is being performed, three PUF samples will be collected each day along with two High Volume Air samples. In addition, a portable optical particulate monitor (mini-RAM) will be used at two hour intervals during excavation to establish instantaneous particulate levels.

The PUF samplers will be located as shown in Figure 1. The PUF sampler B will be located downwind of the area to be excavated. The downwind distance will be determined by applying a Gaussian dispersion model to obtain the maximum groundlevel centerline concentration. An evaluation is currently being conducted by EG&G staff to determine the most conservative yet operationally acceptable location for that sampler. PUF sampler A will be located upwind and will be used as a background monitor. PUF sampler C will be located at the site boundary to monitor any potential transport to offsite areas.

Initially, only sampler B will be analyzed for 2,3,7,8-TCDD. If dioxin is detected at a concentration greater than 3 pg/m^3, then the other two samplers will be analyzed to determine the source of the contamination and the extent of migration to offsite areas. If both the onsite downwind PUF and the offsite downwind PUF, i.e., PUFs B and C, indicated a positive TCDD concentration then the EPA would be notified immediately. That notification would include an explanation of the problem as well as proposed methods to prevent future occurrences. Operations would be discontinued if the modified dust control proved inadequate or per EPA request.

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If no dioxin is detected in the PUF sampler B, then the other two samples will be archived for 90 days and then discarded.

All samplers would be operated continuously for 24 hours with a sample filter and PUF media collected for each day at every PUF sampler station.

The filter catch and PUF cartridges will be analyzed using High Resolution GC/Low Resolution MS techniques. Previous experience with that method has indicated that detection levels in the 1.5 pg/m^3 range are typical. A copy of the proposed analytical method is being sent to the EPA in a separate transmittal from Envirodyne Engineers. Five day turn around on verbal results is expected from the analytical laboratories.

The high volume air samplers will be analyzed gravinemetrically per standard EPA protocol to determine the TSP concentration.

As part of the field quality assurance plan, field duplicates and field blanks will be submitted to the laboratory for analysis. It is currently anticipated that approximately three duplicates and one field blank will be analyzed each week.

Re-Evaluation of Sampling Protocol

After 30 days of excavation are completed, an evaluation will be conducted to determine the feasibility of reducing sampling frequency. EG&G would request a reduction in sampling frequency if the existing data indicated that no significant TCDD concentrations were observed attributable to onsite operations. Pending EPA Region IV approval, based upon the first 30 days of operational data, EG&G would reduce the number of samples to one PUF sample for each 24 hours of actual excavation. Because only 8 to 10 hours of excavation per day are anticipated, the sampling frequency reduction would effectively reduce the number of samples to one every 2.5 to 3 days.

High volume air samplers will be used daily through out the operational phase of the program. By observing the TSP data and any positive PUF data, one could anticipate the need for onsite dust suppression. Currently, dust suppression would be employed when either a High volume air sampler or the mini-ram data indicated that the dust concentration was three times the normal ambient air background. If dust concentrations cannot be reduced through the use of water application, then soil excavation would be suspended until more favorable conditions or excavation techniques were realized. This decision logic is presented schematically in Figure 2.

As part of the ongoing research efforts of the Environmental Restoration Technology Program, an attempt will be made to correlate TSP data with any positive TCDD detections in the PUF samples.

Meteorological Monitoring

Continuous monitoring of the ambient weather conditions will be conducted. Wind speed, direction, temperature, and humidity will be continually recorded and available for subsequent data analysis. Whenever, the wind direction significantly deviates from its previous vector, the air monitors will be moved accordingly. Specific details regarding sampler movement and data gathering will be presented to EPA upon completion of the detailed ambient air monitoring plan.
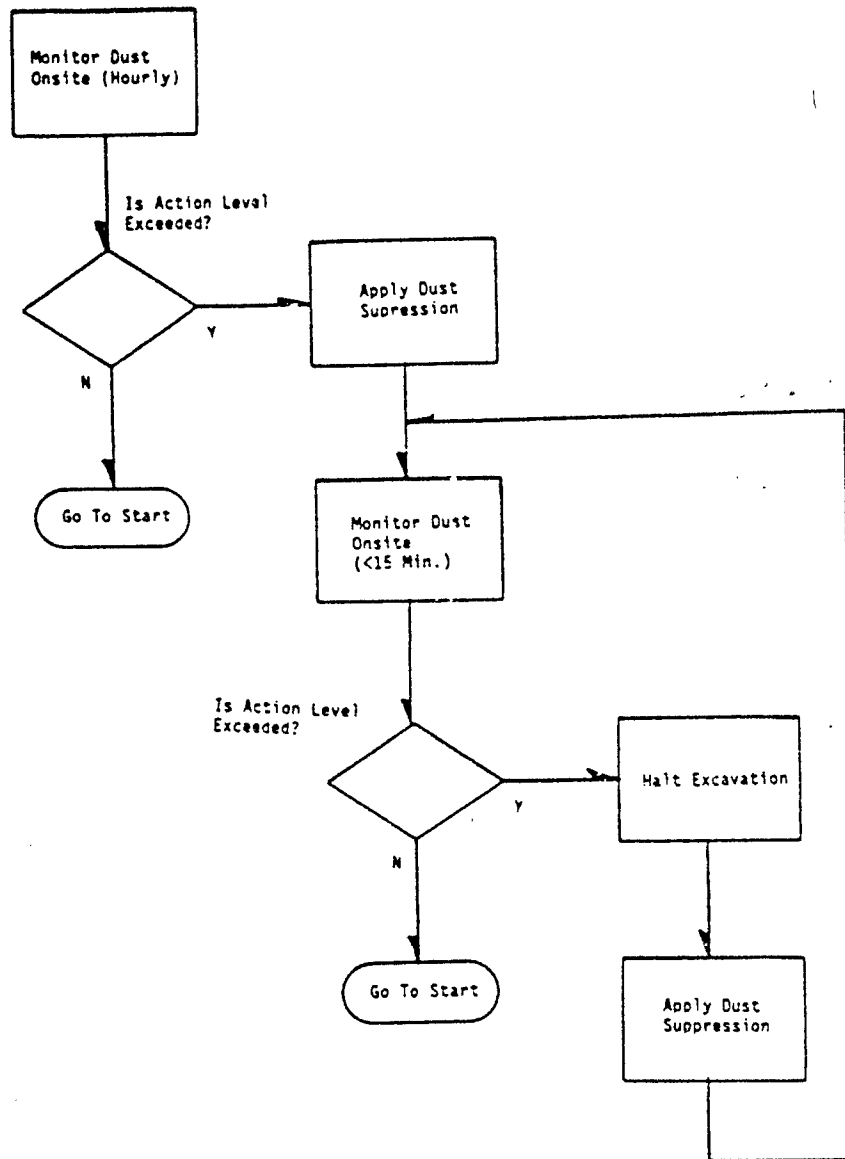
Figure 2. Dust Suppression Decision Logic

2. Levels for opening of the thermal relief vent (TRV) as described on page II-5 of the trial burn plan (TPB) must be specified. If the TRV is opened for any reason other than those specified on page II-5 then EPA must be notified before operation can resume. To ensure that organics are being destroyed during a TRV event, NCBC must maintain minimum operating temperature in the SCC until all hazardous waste exits the kiln. Kiln rotation may be increased to speed up this process.

The TRV can only be opened when an operator manually opens a pneumatic valve which actuates the pneumatic cylinder on the TRV stack. No automatic devices are employed which could automatically open the TRV. The TRV will be opened only as a final emergency effort to prevent major damage to the MWP-2000 boiler and gas quench and scrubbing system.

During an emergency TRV event, the fuel to the kiln and Secondary Combustor is shut off thus extinguishing the flames. Also, the combustion air blowers for both burners are cut back to 35% of their normal operation condition. Extinguishing the flames tends to reduce the secondary temperature. Complete destruction of all organics in the secondary combustor is expected, however, due to the significantly increased residence time resulting from reduced combustion air flow and the thermal inertia of the secondary combustor refractory brick. The residence time in the secondary combustor will be approximately 6 to 7 seconds. As a comparison, during normal operations, the secondary residence time is 2.0 +/- .08 seconds.

Tests were conducted on August 29 and 30 to show the SCC temperature as a function of time following a simulated TRV event. That data will be available to the EPA during the week of September 9, 1987.

To help reduce the time that complete thermal destruction is relying upon long residence times and thermal inertia, the contents of the kiln will be removed as quickly as possible by increasing the kiln rotation to 4.5 rpm.

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Boiler Steam Drum Low-Low Level Alarm.

A low boiler water level observed in the boiler steam drum is almost always caused by the loss of water pumping capability resulting from either a boiler feed pump failure or a treated water pump failure. For a complete loss of water pumping capability, both the primary pumps must fail and the adjacent spare pumps must also fail.

The low-level alarm switch on the steam drum level is actuated at 35% of the level span, i.e., 3 in. below the center line of the steam drum. When the low-level alarm is actuated, the Automatic Waste Feed Shut-Off (AWFSO) is actuated to cut off the soil feed to the kiln. At that time, the operator will start the spare boiler feedwater pump. If the spare pump is also inoperable, then the operators will begin normal shutdown procedures.

If the water level in the drum continues to drop, the low-low level switch is actuated at 10% of the level span, or 8 in. below the steam drum center line. When the low-low level alarm is actuated, the fuel to the kiln and secondary combustor is shut off resulting in flame loss.

The difference between the low level alarm and the low-low level fuel shut off trip is 551 lbs of water. During the trial burn, the boiler was being fed approximately 18,000 lb/hr of water. Therefore, in the event that no make-up water is being fed to the steam drum, the low-low fuel shut off will be actuated approximately 1.8 minutes after the initial low level alarm (and resulting AWFSO) is actuated.

If the water level in the steam continues to drop to 0%, or if the temperature measured at the exit of the boiler rises to 600°F, then the operator must manually actuate the opening of the TRV. This action is necessary in order to prevent excessive overheating of the boiler which would in turn result in significant boiler tube failure. Such a failure would probably necessitate complete boiler replacement.

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This is a worst case scenario. In most instances, when the low-level alarm is actuated, the operating crew will be able to restore water flow to the boiler in time to keep the level above the low-low trip point.

Once fuel shutoff occurs, the kiln rotation will be increased to 4.5 rpm in an effort to remove contaminated soil. This action will mitigate any potential release by reducing the time that contaminated soil is present in the kiln. It may, however necessitate reprocessing some soil to assure complete TCDD removal and destruction. Furthermore, the kiln must remain rotating to prevent refractory sagging or the development of hot spots in the kiln.

Once a low-level alarm is cleared and the problem corrected, the operating crew may restart waste feed if all other operating parameters specified in the RD&D permit are met.

Following a low-low level alarm, the operating crew must clear the alarm, diagnose the problem, and assure that the backup pumps are operable before they can relight the kiln and secondary combustor flames. Waste feed will begin only after all operating conditions as specified in the modified RD&D Permit are met.

Packed Tower Inlet High-High Temperature

A high temperature in the packed tower would be caused only by a loss of quench water supply. A high temperature alarm is actuated at 190°F which causes the AWFSO to be automatically invoked and simultaneously initiates the emergency quench raw water valve to open.

The emergency quench water supply has ample capacity (34 gpm at 50 psig) to maintain the temperature at the 190°F level. It is improbable that the 190°F level would be exceeded unless the emergency quench water water also failed.

If both the quench water supply and the emergency raw water supply is lost, then a high-high alarm would be actuated when the packed tower inlet temperature reaches 220°F. At that time, the operators would manually initiate TRV opening in order to divert hot combustion gases away from the packed tower thus preventing major damage to the packed tower and other air pollution control equipment.

Total Power Failure

During a total loss of electrical power all operations are immediately stopped. The waste feed stops, the kiln rotation stops, and the flames are extinguished. The operating procedures specify immediately dispatching of a person to start the diesel generator and another person to inspect the boiler steam drum level gauge.

Upon loss of power, emergency quench water is automatically applied to the packed tower by virtue of a fail open solenoid valve. Water supply for the emergency quench is supplied by the NCBC water main/fire protection system.

The operator observing the steam drum level gauge will open the TRV by manually opening the TRV actuator valve if the steam drum level reaches the 0% level. This action is necessary in order to prevent excessive overheating of the boiler which would in turn result in significant boiler tube failure. Such a failure would probably necessitate complete boiler replacement.

The operator watching the steam drum level will also read the manual thermometer for the packed tower to ensure that the emergency quench system is functioning and that the packed tower temperature is below the prescribed 190°F limit. If the temperature reaches 220°F, then the operator will initiate manual opening of the TRV to prevent major damage to the packed tower.

If power is restored from offsite sources, and if the TRV was not opened, then all operating parameters will be checked for permit compliance and waste feed to the incinerator will resume.

If emergency diesel backup is used to restore power, and if the TRV has not been opened, then all operating parameters will be checked for permit compliance and operations on clean fuel will continue indefinitely; no waste will be fed to the incinerator when operating on diesel backup power. If offsite power is not restored, then routine shutdown procedures will be invoked.

If the TRV was opened, then emergency shutdown procedures will begin immediately upon restoration of emergency diesel or offsite power. The TRV will be closed as soon as the packed tower inlet temperature is reduced to $190^{\circ}F$ and the level in the steam drum is at 10% or above.

3. The correct stack height for the incinerator must be specified.

The stack height is 36 feet plus 5 feet trailer height, so the top of the stack is 41 feet above ground level.

4. The indicator of combustion gas velocity must be specified.

The residence time, Θ , computed by the Data Acquisition System (DAS) is fundamentally given by:

$$\Theta = \frac{Volume \ of \ SCC}{Volumetric \ flow \ rate \ through \ SCC} \qquad \frac{(ft^3)}{(ft^3/sec)} \qquad (1)$$

As part of a continuing review of the Trial Burn Report which was conducted after submittal to the EPA, several errors were found in the residence time equation presented in the report. The error was detected in the volumetric flow rate calculation which appears in the denominator of equation 1 above. The complete, correct equation is:

$$(2)$$

$$\Theta = \frac{V_s}{\underbrace{\left(\frac{t_s + 460}{530}\right)\left[\frac{G_p + G_s}{3600} + .2373(A_p + A_s) + .0117 A_l\right]}_{\text{"A"}} + \underbrace{\left[66.329 + .0726(t_s - 1400)\right]\left[2.57 \times 10^{-5} F(t_p + 120) + .000523\right]}_{\text{"B"}}}$$

where:

A_p = primary (kiln) combustion air, lbs/min

A_s = secondary combustion air, lbs/min

A_l = primary (kiln) combustion air resulting from air in-leakage around the kiln seals, lbs/min.

t_p = Temperature of the primary chamber at the exit, Deg F.

t_s = Temperature of the secondary combustion chamber at the exit, Deg F.

F = Mass feed rate of sand to the kiln, lbs/min

G_p = Natural gas feed rate to the kiln, SCFH

G_s = Natural gas feed rate to the secondary combustor, SCFH

V_s = Volume of the Secondary combustor, 1378.9 ft³

The term highlighted by "A" in equation 2 represents the contribution to the volumetric flow rate from the natural gas and combustion air. That term is corrected for temperature.

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The term highlighted by "B" in equation 2 represents the contribution to the volumetric flow rate from the steam produced when the hot ash falls into the ash quench as well as the steam produced from the moisture in the feedstock sand.

Equation 2 is fully derived in an attachment to this document. That attachment includes the assumption and unit conversions used for derivation.

The newly derived formula indicates that at the given parameters, the average calculated residence time for the three trial burns is 2.01 seconds with a standard deviation of 0.05 seconds. This value is 17% greater than previously reported.

Figures 3, 4, and 5 show the corrected formula as a function of time for the three trial burns. The previously used formula is also plotted as a comparison.

The corrected residence time for May 12 and 16 uses the mass feed rate obtained directly from the Data Acquisition System. On May 11, however, as previously reported in the Trial Burn Report, the electronic load cells for the weigh hopper were inoperable and the mass feed rate was calculated from manual readings obtained from the mechanical scale on the weigh hopper.

Tables 1, 2, and 3 list the input data for the corrected residence time calculations.

The corrected residence time calculation equation has been programed into the DAS for future operations.

To set the permit operating conditions, EG&G and Ensco recommend that a lower AWFSO set point for residence time be set at 1.92 seconds. This value is not only within two standard deviations of the average residence time but also is the lowest residence time recorded during the three tests.
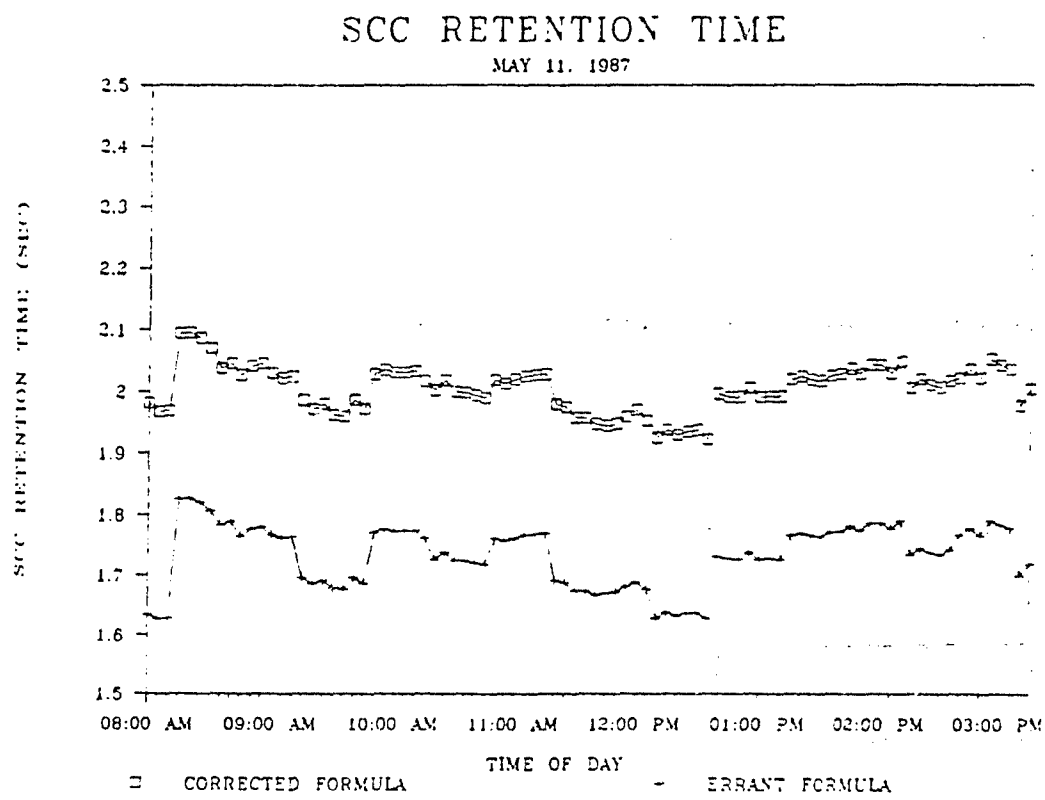
SCC RETENTION TIME
MAY 11, 1987

Figure 3

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SCC GAS RETENTION TIME
12-May

CORRECTED FORMULA   —   ERRANT FORMULA

Figure 4

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SCC GAS RETENTION TIME

16-May

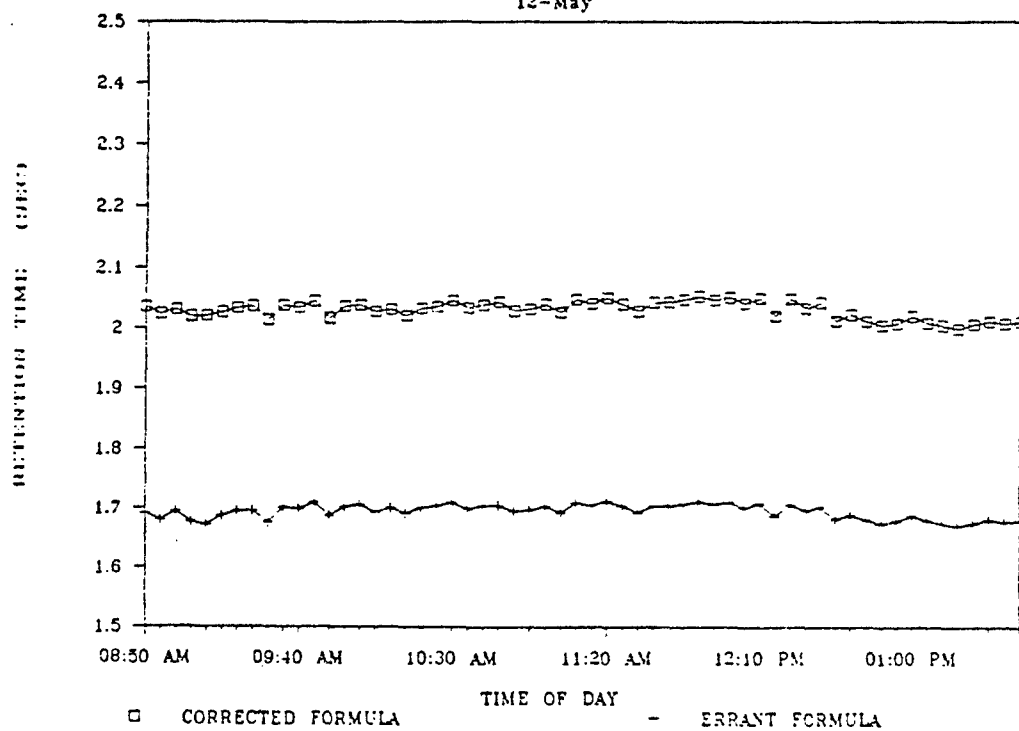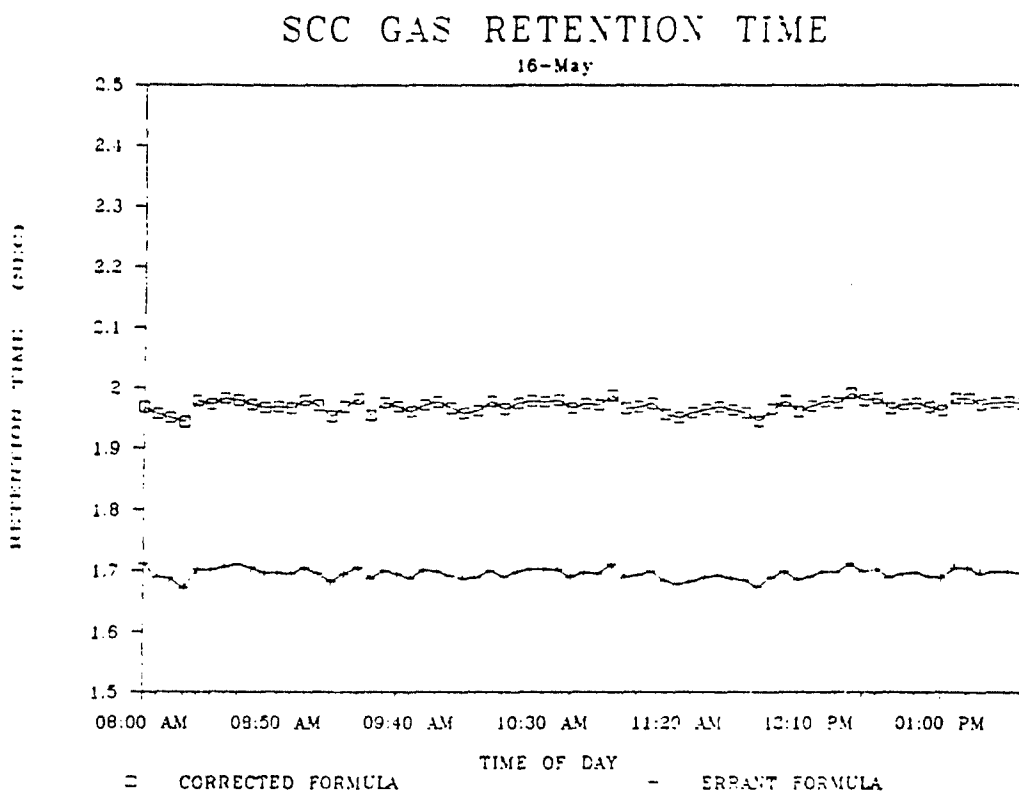

Figure 5

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NCBC FULL SCALE DEMONSTRATION PROJECT
RESIDENCE TIME CALCULATION CORRECTION

DATE	TIME	KILN COMB AIR (#/MIN)	KILN (a) NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC COMB AIR (#/MIN)	SCC NAT GAS (SCCFH)	SCC OUT TEMP (DEG F)	MASS FEED RATE (TONS/HR)	RETENTION TIME (OLD FORMULA) (SEC)	RETENTION TIME (CORRECT FORMULA) (SEC)
AVERAGE VALUE:		169	1433	1456	293	23145	2156	5.12	1.73	2.00
MAXIMUM VALUE:		177	1500	1479	299	23846	2172	6.95	1.83	2.10
MINIMUM VALUE:		150	1299	1431	288	22424	2147	4.58	1.63	1.92
ST.DEV:		4.7	47.4	10.2	1.9	255.3	5.9	0.58	0.50	0.04
11-May	08:00 AM	150	1307	1462	291	22937	2162	6.95	1.63	1.98
11-May	08:05 AM	158	1299	1456	290	22659	2152	6.95	1.63	1.97
11-May	08:10 AM	156	1318	1452	291	22864	2154	6.95	1.63	1.97
11-May	08:15 AM	156	1333	1464	290	22578	2158	4.58	1.83	2.10
11-May	08:20 AM	154	1341	1457	293	22783	2153	4.58	1.83	2.10
11-May	08:25 AM	157	1332	1457	292	22424	2156	4.58	1.82	2.09
11-May	08:30 AM	157	1385	1457	295	22857	2159	4.58	1.81	2.07
11-May	08:35 AM	170	1378	1451	293	22571	2150	4.58	1.78	2.04
11-May	08:40 AM	169	1382	1450	292	22739	2148	4.58	1.79	2.05
11-May	08:45 AM	168	1382	1451	293	23260	2157	4.76	1.77	2.03
11-May	08:50 AM	169	1377	1447	289	23238	2153	4.76	1.78	2.04
11-May	08:55 AM	165	1403	1441	291	23252	2156	4.76	1.78	2.05
11-May	09:00 AM	168	1400	1440	293	23003	2155	4.76	1.77	2.03
11-May	09:05 AM	168	1404	1440	294	23223	2159	4.76	1.76	2.02
11-May	09:10 AM	170	1454	1457	292	22842	2153	4.76	1.76	2.02
11-May	09:15 AM	166	1467	1462	292	23311	2159	5.6	1.70	1.99
11-May	09:20 AM	172	1452	1456	293	22586	2152	5.6	1.69	1.97
11-May	09:25 AM	168	1458	1453	293	23362	2156	5.6	1.69	1.98
11-May	09:30 AM	172	1451	1459	294	23032	2158	5.6	1.68	1.96
11-May	09:35 AM	168	1431	1461	299	23120	2159	5.6	1.68	1.96
11-May	09:40 AM	170	1432	1463	290	22864	2153	5.6	1.70	1.99
11-May	09:45 AM	169	1440	1464	294	23208	2157	5.6	1.69	1.97
11-May	09:50 AM	171	1373	1451	292	22620	2156	4.66	1.77	2.03
11-May	09:55 AM	167	1375	1448	294	23128	2155	4.66	1.78	2.04
11-May	10:00 AM	170	1396	1456	292	23018	2154	4.66	1.77	2.03
11-May	10:05 AM	169	1423	1448	293	23164	2153	4.66	1.77	2.03
11-May	10:10 AM	167	1429	1459	293	23025	2158	4.66	1.77	2.03

Table 1

NCBC FULL SCALE DEMONSTRATION PROJECT
RESIDENCE TIME CALCULATION CORRECTION

ATE	TIME	KILN COMB AIR (#/MIN)	KILN (a) NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC COMB AIR (#/MIN)	SCC NAT GAS (SCCFH)	SCC OUT TEMP (DEG F)	MASS FEED RATE (TONS/HR)	RETENTION TIME (OLD FORMULA) (SEC)	RETENTION TIME (CORRECT FORMULA) (SEC)
1-May	10:15 AM	169	1426	1465	296	22945	2156	4.66	1.76	2.02
1-May	10:20 AM	169	1422	1461	292	23128	2156	5.19	1.73	2.00
1-May	10:25 AM	167	1390	1450	291	23032	2154	5.19	1.74	2.02
1-May	10:30 AM	171	1425	1456	292	23025	2153	5.19	1.72	2.00
1-May	10:35 AM	172	1421	1456	292	23054	2149	5.19	1.72	2.00
1-May	10:40 AM	172	1418	1457	292	23047	2155	5.19	1.72	1.99
1-May	10:45 AM	174	1418	1461	292	22879	2151	5.19	1.72	1.99
1-May	10:50 AM	173	1410	1462	291	23069	2153	4.73	1.76	2.02
1-May	10:55 AM	172	1385	1451	295	23047	2151	4.73	1.76	2.01
1-May	11:00 AM	173	1388	1443	291	23059	2156	4.73	1.76	2.02
1-May	11:05 AM	172	1400	1441	292	23120	2149	4.73	1.77	2.02
1-May	11:10 AM	171	1406	1431	292	23472	2151	4.73	1.77	2.03
1-May	11:15 AM	171	1402	1438	293	22871	2147	4.73	1.77	2.03
1-May	11:20 AM	172	1500	1437	290	23150	2151	5.64	1.69	1.98
1-May	11:25 AM	172	1500	1448	291	23223	2150	5.64	1.69	1.98
1-May	11:30 AM	173	1500	1458	293	23479	2157	5.64	1.67	1.96
1-May	11:35 AM	173	1500	1461	294	23164	2154	5.64	1.67	1.96
1-May	11:40 AM	175	1500	1465	293	23362	2160	5.64	1.67	1.95
1-May	11:45 AM	175	1500	1467	296	23355	2161	5.49	1.67	1.94
1-May	11:50 AM	174	1500	1464	296	23413	2162	5.49	1.67	1.95
1-May	11:55 AM	175	1500	1471	292	23113	2159	5.49	1.68	1.96
-May	12:00 PM	172	1450	1459	292	23245	2163	5.49	1.69	1.97
-May	12:05 PM	177	1451	1462	293	23252	2158	5.49	1.68	1.95
-May	12:10 PM	173	1451	1456	295	23347	2162	6.16	1.63	1.92
-May	12:15 PM	172	1445	1456	293	23084	2158	6.16	1.64	1.94
-May	12:20 PM	171	1452	1449	296	23516	2160	6.16	1.63	1.93
-May	12:25 PM	173	1454	1453	293	23487	2156	6.16	1.64	1.94
-May	12:30 PM	170	1460	1452	294	23494	2162	6.16	1.64	1.94
-May	12:35 PM	175	1456	1449	296	23230	2154	6.16	1.63	1.92
-May	12:40 PM	170	1463	1461	294	23501	2160	4.99	1.73	2.00
-May	12:45 PM	173	1453	1466	294	23347	2153	4.99	1.73	1.99
-May	12:50 PM	171	1461	1468	293	23846	2164	4.99	1.73	1.99
-May	12:55 PM	170	1456	1472	291	23230	2160	4.99	1.74	2.01
-May	01:00 PM	170	1462	1473	294	23332	2165	4.99	1.73	1.99
-May	01:05 PM	171	1457	1471	294	23135	2161	4.99	1.73	1.99
-May	01:10 PM	169	1461	1479	293	23384	2172	4.99	1.73	1.99

NOTE: a. The Ensco OAS computer truncated the rightmost digit of the Kiln Gas Usage values. The
correct gas usage value is available by multiplying the values in this column by a factor
of 10. All calculations, both old and corrected, reflect this correction.

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DATE	TIME	KILN COMB AIR (#/MIN)	KILN (a) NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC COMB AIR (#/MIN)	SCC NAT GAS (SCCFH)	SCC OUT TEMP (DEG F)	MASS FEED RATE (TONS/HR)	RETENTION TIME (OLD FORMULA) (SEC)	RETENTION TIME (CORRECT FORMULA) (SEC)
11-May	01:15 PM	169	1462	1474	293	23245	2165	4.59	1.77	2.02
11-May	01:20 PM	170	1459	1476.	290	23377	2167	4.59	1.77	2.02
11-May	01:25 PM	169	1457	1476	293	23699	2163	4.59	1.77	2.02
11-May	01:30 PM	170	1457	1470	293	23340	2165	4.59	1.76	2.02
11-May	01:35 PM	170	1426	1468	291	23355	2164	4.59	1.77	2.03
11-May	01:40 PM	168	1412	1472	291	23369	2170	4.59	1.77	2.03
11-May	01:45 PM	169	1369	1455	291	23076	2161	4.59	1.73	2.04
11-May	01:50 PM	170	1385	1445	292	23194	2163	4.59	1.77	2.03
11-May	01:55 PM	168	1383	1440	292	22952	2156	4.59	1.79	2.34
11-May	02:00 PM	168	1421	1445	291	23223	2156	4.59	1.79	2.04
11-May	02:05 PM	170	1431	1442	294	22864	2152	4.59	1.78	2.03
11-May	02:10 PM	167	1443	1443	290	23282	2158	4.59	1.79	2.05
11-May	02:15 PM	170	1442	1437	293	22893	2152	5.12	1.73	2.01
11-May	02:20 PM	166	1477	1443	291	23157	2156	5.12	1.74	2.02
11-May	02:25 PM	171	1480	1441	290	22974	2151	5.12	1.74	2.01
11-May	02:30 PM	169	1493	1457	292	23186	2152	5.12	1.73	2.01
11-May	02:35 PM	168	1489	1451	291	23025	2149	5.12	1.74	2.02
11-May	02:40 PM	169	1487	1445	295	23267	2152	4.66	1.77	2.02
11-May	02:45 PM	169	1482	1457	290	23611	2152	4.66	1.78	2.04
11-May	02:50 PM	168	1484	1452	295	23142	2157	4.66	1.77	2.02
11-May	02:55 PM	167	1472	1456	283	23340	2152	4.66	1.79	2.05
11-May	03:00 PM	167	1472	1449	291	23062	2153	4.66	1.78	2.04
11-May	03:05 PM	167	1474	1454	293	23010	2152	4.66	1.78	2.04
11-May	03:10 PM	170	1475	1456	295	23494	2154	5.39	1.70	1.98
11-May	03:15 PM	168	1478	1455	289	23282	2155	5.39	1.72	2.00

NOTE: a.   The Ensco OAS computer truncated the rightmost digit of the Kiln Gas Usage values. The correct gas usage value is available by multiplying the values in this column by a factor of 10. All calculations, both old and corrected, reflect this correction.

NCBC FULL SCALE DEMONSTRATION PROJECT
RESIDENCE TIME CALCULATION CORRECTION

DATE	TIME	KILN COMB AIR (#/MIN)	KILN (a) NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC COMB AIR (#/MIN)	SCC NAT GAS (SCCFH)	SCC OUT TEMP (DEG F)	MASS FEED RATE (TONS/HR)	RETENTION TIME (OLD FORMULA) (SEC)	RETENTION TIME (CORRECT FORMULA) (SEC)
AVERAGE VALUE:		181	1478	1457	287	23465	2157	5.3	1.69	2.03
MAXIMUM VALUE:		189	1500	1470	294	24000	2173	5.6	1.71	2.05
MINIMUM VALUE:		175	1445	1442	282	22857	2147	5.2	1.76	2.00
ST.DEV:		2.2	14.7	6.4	3.2	309.2	6.1	0.1	0.012	0.014
12-May	08:50 AM	175	1495	1468	287	23809	2171	5.4	1.69	2.04
12-May	08:55 AM	181	1496	1470	285	23494	2164	5.5	1.68	2.02
12-May	09:00 AM	178	1499	1466	287	23772	2170	5.3	1.69	2.03
12-May	09:05 AM	181	1494	1468	284	23721	2173	5.5	1.68	2.02
12-May	09:10 AM	179	1497	1463	285	23728	2172	5.6	1.67	2.02
12-May	09:15 AM	181	1450	1463	285	23384	2171	5.4	1.69	2.03
12-May	09:20 AM	181	1446	1456	285	23326	2166	5.3	1.70	2.03
12-May	09:25 AM	181	1453	1455	285	23260	2159	5.4	1.70	2.04
12-May	09:30 AM	184	1445	1455	287	23443	2159	5.5	1.68	2.02
12-May	09:35 AM	180	1477	1445	287	23113	2157	5.3	1.70	2.04
12-May	09:40 AM	184	1472	1449	284	23091	2157	5.3	1.70	2.03
12-May	09:45 AM	182	1482	1447	284	23347	2154	5.2	1.71	2.05
12-May	09:50 AM	189	1500	1460	284	22857	2157	5.3	1.69	2.02
12-May	09:55 AM	181	1500	1456	287	23289	2154	5.3	1.70	2.04
12-May	10:00 AM	184	1437	1463	285	22981	2149	5.2	1.71	2.04
12-May	10:05 AM	184	1486	1457	285	23347	2158	5.3	1.69	2.03
12-May	10:10 AM	183	1469	1460	288	23164	2152	5.2	1.70	2.03
12-May	10:15 AM	185	1455	1456	283	23355	2154	5.2	1.69	2.02
12-May	10:20 AM	183	1459	1465	286	23186	2156	5.2	1.70	2.03
12-May	10:25 AM	184	1459	1452	284	23172	2159	5.2	1.70	2.04
12-May	10:30 AM	182	1464	1455	284	23326	2152	5.3	1.71	2.05
12-May	10:35 AM	183	1454	1449	286	23091	2155	5.3	1.70	2.03
12-May	10:40 AM	181	1463	1447	287	23648	2151	5.3	1.70	2.04

Table 2

NCBC FULL SCALE DEMONSTRATION PROJECT
RESIDENCE TIME CALCULATION CORRECTION

DATE	TIME	KILN COMB AIR (#/MIN)	KILN (a) NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC COMB AIR (#/MIN)	SCC NAT GAS (SCCFH)	SCC OUT TEMP (DEG F)	MASS FEED RATE (TONS/HR)	RETENTION TIME (OLD FORMULA) (SEC)	RETENTION TIME (CORRECT FORMULA) (SEC)
12-May	10:45 AM	184	1491	1442	282	23113	2153	5.3	1.70	2.04
12-May	10:50 AM	181	1500	1456	288	23428	2158	5.3	1.69	2.03
12-May	10:55 AM	183	1500	1464	286	22923	2155	5.3	1.70	2.03
12-May	11:00 AM	178	1500	1468	289	23406	2152	5.3	1.70	2.04
12-May	11:05 AM	183	1500	1467	288	22930	2152	5.3	1.69	2.03
12-May	11:10 AM	179	1484	1460	286	23472	2152	5.3	1.71	2.05
12-May	11:15 AM	181	1473	1460	287	23296	2149	5.3	1.70	2.04
12-May	11:20 AM	179	1465	1455	286	23238	2152	5.3	1.71	2.05
12-May	11:25 AM	179	1470	1451	290	23333	2147	5.3	1.70	2.04
12-May	11:30 AM	181	1463	1451	288	23611	2157	5.3	1.69	2.03
12-May	11:35 AM	180	1466	1453	285	23736	2157	5.3	1.70	2.04
12-May	11:40 AM	180	1467	1451	285	23245	2158	5.3	1.70	2.04
12-May	11:45 AM	179	1471	1455	285	23311	2157	5.3	1.71	2.05
12-May	11:50 AM	182	1466	1453	282	22939	2152	5.3	1.71	2.05
12-May	11:55 AM	178	1472	1451	287	23611	2153	5.3	1.71	2.05
12-May	12:00 PM	182	1481	1456	283	23172	2147	5.3	1.71	2.05
12-May	12:05 PM	180	1485	1456	285	23956	2155	5.3	1.70	2.04
12-May	12:10 PM	180	1485	1444	285	23318	2150	5.3	1.71	2.05
12-May	12:15 PM	180	1487	1451	291	23501	2158	5.3	1.69	2.02
12-May	12:20 PM	178	1486	1455	286	23487	2153	5.3	1.71	2.05
12-May	12:25 PM	179	1486	1454	289	23575	2155	5.3	1.70	2.03
12-May	12:30 PM	181	1491	1455	285	23472	2151	5.3	1.70	2.04
12-May	12:35 PM	181	1481	1453	294	23450	2152	5.3	1.68	2.01
12-May	12:40 PM	180	1481	1455	292	23677	2150	5.3	1.69	2.02
12-May	12:45 PM	182	1480	1457	292	24060	2153	5.3	1.68	2.01
12-May	12:50 PM	181	1487	1454	294	23941	2157	5.4	1.67	2.00
12-May	12:55 PM	184	1476	1464	291	23860	2154	5.3	1.68	2.01
12-May	01:00 PM	180	1487	1456	290	23904	2162	5.3	1.69	2.02
12-May	01:05 PM	181	1482	1456	294	23665	2157	5.3	1.68	2.01
12-May	01:10 PM	181	1480	1449	294	23934	2158	5.4	1.67	2.00
12-May	01:15 PM	183	1477	1460	294	23721	2155	5.4	1.67	2.00
12-May	01:20 PM	182	1479	1458	291	23970	2162	5.4	1.67	2.01
12-May	01:25 PM	181	1481	1462	291	23941	2163	5.3	1.68	2.01
12-May	01:30 PM	182	1483	1463	291	23882	2162	5.3	1.68	2.01
12-May	01:35 PM	180	1483	1463	292	23985	2161	5.3	1.68	2.01
12-May	01:40 PM	182	1478	1463	291	23985	2160	5.3	1.68	2.01
12-May	01:45 PM	182	1484	1461	293	24000	2159	5.3	1.68	2.00
12-May	01:50 PM	181	1474	1467	294	23712	2162	5.3	1.67	2.00
12-May	01:55 PM	179	1484	1456	292	23953	2160	5.3	1.68	2.02
12-May	02:00 PM	183	1471	1467	293	23736	2162	5.3	1.67	2.00

DATE	TIME	KILN COMB AIR (#/MIN)	KILN (a) NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC COMB AIR (#/MIN)	SCC NAT GAS (SCCFH)	SCC OUT TEMP (DEG F)	MASS FEED RATE (TONS/HR)	RETENTION TIME (OLD FORMULA) (SEC)	RETENTION TIME (CORRECT FORMULA) (SEC)
12-May	02:05 PM	179	··37	1456	295	23992	2163	5.3	1.68	2.01
12-May	02:10 PM	183	1427	1447	291	23655	216·	5.3	1.68	2.01
12-May	02:15 PM	181	1429	1445	293	23824	21·3	5.3	1.68	2.01
12-May	02:20 PM	181	1434	1437	295	23706	2163	5.3	1.67	2.00
12-May	02:25 PM	181	1478	1445	296	23824	2160	5.3	1.67	2.00
12-May	02:30 PM	180	1476	1439	289	23721	2·52	5.3	1.70	2.03
12-May	02:35 PM	183	1468	1442	294	23692	2158	5.3	1.67	2.00
12-May	02:40 PM	180	1469	1435	292	23772	2151	5.3	1.69	2.03
12-May	02:45 PM	183	1496	1447	290	24000	2154	5.3	1.68	2.01
12-May	02:50 PM	179	1499	1444	292	23897	2154	5.3	1.69	2.02
12-May	02:55 PM	183	1311	1471	292	23340	2149	5.2	1.69	2.02
12-May	03:00 PM	181	9958	1428	292	23802	2152	5.2	1.49	1.73
31909	03:05 PM	182	8846	1445	295	23032	2155	5.1	1.51	1.76
31909	03:10 PM	182	8814	1450	291	22739	2153	5.0	1.52	1.77
31909	03:15 PM	179	7422	1432	292	22652	2153	5.0	1.56	1.82
31909	03:20 PM	182	7206	1403	284	21963	2148	4.9	1.59	1.86
31909	03:25 PM	180	5998	1379	283	21084	2140	4.9	1.63	1.91
31909	03:30 PM	183	5920	1327	288	20613	2102	4.8	1.66	1.9·

NOTE: a. The Ensco DAS computer truncated the highmost digit of the Kiln Gas Usage values. The correct gas usage value is available by multiplying the values in this column by a factor of 10. All calculations, both old and corrected, reflect this correction.

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DATE	TIME	KILN COMB AIR (#/MIN)	KILN (a) NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC COMB AIR (#/MIN)	SCC NAT GAS (SCCFH)	SCC OUT TEMP (DEG F)	MASS FEED RATE (TONS/HR)	RETENTION TIME (OLD FORMULA) (SEC)	RETENTION TIME (CORRECT FORMULA) (SEC)
16-May	10:10 AM	181	1460	1464	283	23428	2159	5.3	1.70	1.98
16-May	10:15 AM	184	1454	1456	283	23421	2162	5.4	1.69	1.97
16-May	10:20 AM	181	1467	1457	283	23589	2163	5.3	1.70	1.97
16-May	10:25 AM	181	1467	1454	284	23457	2156	5.3	1.70	1.98
16-May	10:30 AM	181	1473	1448	285	23421	2156	5.3	1.70	1.98
16-May	10:35 AM	180	1475	1452	285	23501	2151	5.4	1.70	1.98
16-May	10:40 AM	183	1500	1457	284	23575	2157	5.4	1.69	1.97
16-May	10:45 AM	181	1497	1458	284	23553	2159	5.3	1.70	1.97
16-May	10:50 AM	183	1470	1466	284	23326	2151	5.4	1.70	1.97
16-May	10:55 AM	180	1482	1471	282	23633	2155	5.3	1.71	1.99
16-May	11:00 AM	182	1473	1467	284	23326	2163	5.4	1.69	1.97
16-May	11:05 AM	183	1472	1467	284	23304	2155	5.4	1.69	1.97
16-May	11:10 AM	181	1470	1463	286	23479	2152	5.3	1.70	1.97
16-May	11:15 AM	185	1480	1452	287	23274	2152	5.4	1.68	1.96
16-May	11:20 AM	180	1500	1469	290	23730	2161	5.4	1.68	1.95
16-May	11:25 AM	182	1500	1475	285	23725	2159	5.4	1.68	1.96
16-May	11:30 AM	182	1497	1464	284	23560	2163	5.4	1.69	1.96
16-May	11:35 AM	182	1497	1465	283	23787	2160	5.4	1.69	1.97
16-May	11:40 AM	182	1492	1477	284	23340	2163	5.4	1.69	1.96
16-May	11:45 AM	181	1487	1459	287	23750	2163	5.4	1.68	1.96
16-May	11:50 AM	184	1437	1466	287	23604	2165	5.4	1.67	1.94
16-May	11:55 AM	180	1484	1466	285	23677	2166	5.4	1.69	1.96
16-May	12:00 PM	180	1487	1465	282	23853	2161	5.4	1.70	1.98
16-May	12:05 PM	183	1482	1463	284	23604	2164	5.4	1.69	1.96
16-May	12:10 PM	178	1492	1471	285	23699	2165	5.4	1.69	1.97
16-May	12:15 PM	182	1423	1454	284	22989	2153	5.4	1.70	1.98
16-May	12:20 PM	179	1449	1464	287	23334	2152	5.4	1.70	1.97
16-May	12:25 PM	180	1461	1457	283	23010	2150	5.3	1.71	1.99
16-May	12:30 PM	179	1480	1459	283	23501	2161	5.4	1.70	1.98
16-May	12:35 PM	181	1488	1467	281	23457	2156	5.4	1.70	1.98
16-May	12:40 PM	182	1481	1461	285	23260	2158	5.4	1.69	1.97
16-May	12:45 PM	177	1489	1456	288	23589	2160	5.4	1.70	1.97
16-May	12:50 PM	184	1483	1462	281	23428	2156	5.4	1.70	1.97
16-May	12:55 PM	179	1494	1465	287	23604	2158	5.4	1.69	1.97
16-May	01:00 PM	184	1487	1461	285	23296	2156	5.4	1.69	1.96
16-May	01:05 PM	180	1489	1463	282	23633	2160	5.3	1.70	1.98
16-May	01:10 PM	180	1488	1468	283	23567	2155	5.3	1.70	1.98
16-May	01:15 PM	181	1489	1461	285	23443	2152	5.4	1.70	1.97
16-May	01:20 PM	180	1489	1464	285	23633	2155	5.4	1.70	1.97
16-May	01:25 PM	183	1482	1464	282	23201	2153	5.4	1.70	1.98
16-May	01:30 PM	180	1487	1452	285	23619	2158	5.4	1.70	1.97
16-May	01:35 PM	179	1490	1455	287	23589	2149	5.4	1.70	1.98

NCBC FULL SCALE DEMONSTRATION PROJECT
RESIDENCE TIME CALCULATION CORRECTION

DATE	TIME	KILN COMB AIR (#/MIN)	KILN (a) NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC COMB AIR (#/MIN)	SCC NAT GAS (SCCFH)	SCC OUT TEMP (DEG F)	MASS FEED RATE (TONS/HR)	RETENTION TIME (OLD FORMULA) (SEC)	RETENTION TIME (CORRECT FORMULA) (SEC)
AVERAGE VALUE:		181	1455	1462	285	23556	2159	5.0	1.74	2.00
MAXIMUM VALUE:		185	1500	1477	290	24000	2172	6.0	2.55	2.56
MINIMUM VALUE:		153	1160	1448	258	21699	2145	4.9	1.63	1.92
ST.DEV:		4.5	53.4	7.0	4.7	403.8	5.7	1.2	0.15	0.09
16-May	08:00 AM	183	1468	1470	287	23992	2169	4.9	1.71	1.97
16-May	08:05 AM	181	1471	1472	287	24000	2172	5.2	1.69	1.96
16-May	08:10 AM	183	1473	1472	289	23970	2169	5.1	1.69	1.95
16-May	08:15 AM	182	1394	1468	289	23978	2172	5.4	1.67	1.94
16-May	08:20 AM	179	1363	1448	286	23633	2161	5.3	1.70	1.98
16-May	08:25 AM	184	1408	1449	284	23450	2158	5.3	1.70	1.97
16-May	08:30 AM	177	1440	1454	287	23538	2156	5.3	1.71	1.98
16-May	08:35 AM	180	1446	1455	287	23523	2157	5.2	1.71	1.98
16-May	08:40 AM	183	1473	1459	286	23479	2154	5.2	1.70	1.97
16-May	08:45 AM	180	1472	1463	289	23677	2154	5.3	1.70	1.97
16-May	08:50 AM	181	1453	1467	287	23567	2156	5.3	1.70	1.97
16-May	08:55 AM	180	1462	1467	287	23758	2163	5.3	1.70	1.97
16-May	09:00 AM	183	1459	1468	281	23567	2159	5.3	1.71	1.98
16-May	09:05 AM	180	1451	1472	286	23626	2158	5.3	1.70	1.97
16-May	09:10 AM	183	1447	1470	289	23523	2158	5.3	1.68	1.95
16-May	09:15 AM	183	1447	1466	284	23487	2159	5.3	1.69	1.97
16-May	09:20 AM	180	1447	1470	284	23611	2156	5.3	1.71	1.98
16-May	09:25 AM	184	1437	1466	290	23208	2153	5.3	1.69	1.95
16-May	09:30 AM	179	1449	1457	287	23589	2155	5.3	1.70	1.98
16-May	09:35 AM	182	1446	1457	286	23538	2154	5.4	1.69	1.97
16-May	09:40 AM	182	1452	1452	288	23479	2157	5.4	1.69	1.96
16-May	09:45 AM	182	1457	1451	287	23545	2152	5.3	1.70	1.97
16-May	09:50 AM	181	1453	1453	284	23399	2157	5.4	1.70	1.98
16-May	09:55 AM	180	1459	1448	283	23604	2157	5.4	1.69	1.97
16-May	10:00 AM	183	1452	1459	288	23333	2157	5.3	1.69	1.96
16-May	10:05 AM	181	1461	1458	287	23611	2160	5.4	1.69	1.96

NOTE: a. The Ensco DAS computer truncated the rightmost digit of the Kiln Gas Usage values. The correct gas usage value is available by multiplying the values in this column by a factor of 10. All calculations, both old and corrected, reflect this correction.

Table 3

Table 4
PACKED TOWER AND JET SCRUBBER DATA
NCBC TRIAL BURN

	Packed Tower Recirculation Flow (GPM)	Jet Scrubber Recirculation Flow (GPM)
Run 7A:		
Average	146	38
Maximum	148	39
Minimum	143	37
Standard Deviation	0.06	0.3
Run 7B:		
Average	128	36
Maximum	145	38
Minimum	100	35
Standard Deviation	9.4	0.8
Run 7C:		
Average	122	37
Maximum	123	38
Minimum	122	35
Standard Deviation	0.4	0.6

5. The procedure for determining waste feed rate from auger speed must be specified.

Because the RCRA Trial Burn tests used relatively dry sand whereas routine operations will use moist native soil, the auger speed and mass feed rate data obtained during the trial burn tests is not directly applicable to routine operational control. Furthermore, the mass feed rate and auger speed data obtained during the Verification Test Burn in December, 1986 cannot be used to set operational conditions because of the variability and inconclusiveness in that data. Therefore, EG&G and Ensco have conducted a series of tests on August 29 and 30 which used noncontaminated native soil to correlate auger speed and mass feed rate. Those tests employed a recently installed mass feed rate control system in which the weigh hopper load cell data was used by the Data Acquisition System to control the auger speed.

Using the data from that test, EG&G and Ensco hope to demonstrate the validity of controlling the feed auger speed with the mass feed rate data obtained from the weigh hopper load cells. It is also hoped that the test data will provide EPA with sufficient information to confidently set a permit condition for the maximum mass feed rate or auger speed.

Results from the test are currently being evaluated. A complete test description and data analysis will be forwarded to the EPA for incorporation into the permit operating conditions.

After approximately 30 days of operational experience is obtained, EG&G may wish to propose to the EPA Region IV staff that the auger speed limit be modified to more accurately limit the mass feed rate. That request will would be based upon additional operational data that could demonstrate conservativeness in the anticipated initial auger speed set point. No request will be made to raise the mass feed rate limit demonstrated during the RCRA Trial Burns.

6. Automatic waste feed shut-off must be specified for the indicator of combustion gas velocity. Combustion efficiency as described on page III-36 of the TBP cannot be used. In addition to the AWFSOs described on page III-36, AWFSOs must be set for maximum waste feed rate, HCl emissions, and particulate (PT) control. As discussed, quench re-circulation water flow rate and packed tower re-circulation water flow will be used for AWFSO for HCl control. Levels for each of the AWFSOs will be specified based on results from the trial burn.

a. Combustion Gas Velocity: As noted in item four (4) above, the secondary combustor residence time is continuously calculated by the DAS computer. The combustion gas velocity is derived from the residence time calculation by:

$$\Theta = \frac{\text{Volume of SCC}}{\text{Volumetric flow rate}} = \frac{V_s}{Q} \qquad (1)$$

$$\Theta = \frac{\left(\frac{\pi D_s^2}{4}\right) L_s}{\left(\frac{\pi D^2}{4}\right) v_s}$$

$$\Theta = \frac{L_s}{v_s} \qquad (3)$$

where:

         = Residence time, sec

V_s = Volume of Secondary Combustor, 1378.9 cubic ft

Q = Volumetric flow rate through SCC, ft^3/sec.

D_s = Internal diameter of SCC, ft

L_s = Internal length of SCC 40 ft.

v_s = Velocity of gas through SCC, ft/sec

therefore:

$$v_s = \frac{L_s}{\Theta} \qquad (4)$$

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Because combustion gas velocity is a direct function of the residence time calculation, only the residence time calculation is used for operational control.

Currently, the AWFSO for low residence time is set at 1.10 seconds, as calculated by the errant equation (see response to item 4). The lowest residence time observed during the trial burn, as calculated by the corrected equation is 1.92 seconds which is equivalent to 20.83 ft/sec; the AWFSO residence time setpoint is recommended to be no higher than 1.92 seconds.

b. Combustion Efficiency: The AWFSO trip point is at 99%. This value will never be reached, however, because the carbon monoxide analyzer will trip the AWFSO at about 50 ppm CO in stack gas; at normal operating conditions, with about 8% CO_2 in the stack gas the calculated combustion efficiency will still be 99.93%.

c. Maximum Waste Feed Rate: The maximum waste feed rate will be controlled by the feed auger speed. As described in the response to item 5, the auger speed will be correlated to the waste feed rate during a clean soil test. It is recommended that the auger speed be set to activate the AWFSO when the speed that correlates to 5.3 ton/hr is reached.

d. HCL Emissions: This is set by packed tower re-circulation water flow-rate, and presently trips at 75 gpm. Normal flow rate is 120 gpm or higher. The flow rate observed during the RCRA Trial Burns is given in Table 4

e. Particulate Emissions: The statement that low steam pressure to the jet will be used for particulate control AWFSO is questioned. Steam pressure to the jet varies sharply with soil feed rate and soil moisture content.

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For any given mass feed rate a small decrease in pressure to the jet causes loss of draft at the kiln outlet and that AWFSO is tripped. It is recommended that the jet scrubber re-circulation water flow be used as the particulate control AWFSO instead. Normal flow for this stream is 35 gpm or higher; the AWFSO is set at 30 gpm. The jet scrubber recirculation water flow rate observed during the trail burn is given in Table 4

7. The correct operating parameters to be monitored must be specified on pages II-32 through II-34 of the TBP. For examples, on page II-32 it states that pressure drop across the SCC is monitored however, the actual parameter being monitored is SCC draft. Please make the appropriate changes.

The requested corrections have been made to pages II-32, -33, and -34 of the Trial Burn Plan and copies are attached.

MONITORING OF OTHER OPERATING PARAMETERS

Parameter	Method	Frequency	Location	Contingency
ROTARY KILN				
Combustion air air feed rate	Annubar	Continually[d]	10	c
Burner flame	Flame detector	Continually[d]	11	c
Outlet gas temperature	Thermocouple	Continually[d]	12	c
Outlet draft	Pressure transducer	Continually[d]	13	c
SECONDARY COMBUSTOR				
Combustion air feed rate	Annubar	Continually[d]	14	c
Burner flame	Flame detector	Continually[d]	15	c
Outlet draft	Pressure transducer	Continually[d]	16	Repair as soon as possible

MONITORING OF OTHER OPERATING PARAMETERS (continued)

Parameter	Method	Frequency	Location	Contingency
WASTE HEAT BOILER				
Outlet gas temperature	Thermocouple	Continually[d]	18	Repair as soon as possible
Boiler Outlet Draft	Pressure transducer	Continually[d]	19	Repair as soon as possible
Steam pressure	Pressure indicator	Continually[d]	20	Repair as soon as possible
Steam drum water level	Water level switches	Continually[d]	22	c
Make-up water flow rate	Orifice plate flow meter	Continually[d]	23	Repair as soon as possible
EFFLUENT NEUTRALIZATION SYSTEM				
Recirculation flow rate	Magnetic flow meter	Continually[d]	24	Repair as soon as possible
Recirculation flow low pressure	Pressure switch	Continually[d]	25	Repair as soon as possible
Outlet gas temperature	Thermocouple	Continually[d]	27	Replace with spare thermocouple
PACKED TOWER				
Recirculation flow rate	Magnetic flow meter	Continually[d]	28	c
Recirculation flow rate from effluent neutralization tank	Magnetic flow meter	Continually[d]	29	Repair as soon as possible
Make-up water flow rate	Orifice plate flow meter	Continually[d]	30	Repair as soon as possible

II-33

Parameter	Method	Frequency	Location	Contingency
PACKED TOWER (continued)				
Sump water level	Water level switches	Continually[d]	31	Repair as soon as possible
Outlet draft	Pressure transducer	Continually[d]	40	Repair as soon as possible
EJECTOR SCRUBBER				
Inlet gas temperature	Thermocouple	Continually[d]	40	Replace with spare thermocouple
Outlet gas temperature	Thermocouple	Continually[d]	41	Same as above
Steam low pressure	Low pressure switch	Continually[d]	32	Use redundant pressure meter until switch is repaired
Pressure drop demister	Differential pressure transducer	Continually[d]	33	Repair as soon as possible
Recirculation flow rate	Orifice plate flow meter	Continually[d]	34	b
Make-up water flow rate	Orifice plate flow meter	Continually[d]	35	Repair as soon as possible
Sump water level	Water level switches	Continually[d]	36	Use sight glass until switches are repaired
Caustic flow rate	Volumeteric measure from containers	Continually[d]	37	N/A

II-34

EG&G Idaho, Inc.

OEM EG&G-1582
Rev 5-771

CALCULATION WORK SHEET

Subject _SECONDARY COMBUSTOR RESIDENCE TIME_ Date _8-25-87_

Prepared By _S. W. DEIRO_ _____ Checked _____ Work Request _____

THE RESIDENCE TIME OF THE GASES AND STEAM FLOWING THROUGH THE ENSCO MWP-2000 MOBILE INCINERATOR SECONDARY COMBUSTION CHAMBER IS A FUNCTION OF THE FOLLOWING PARAMETERS.

1. PRIMARY AND SECONDARY COMBUSTION AIR $(A_p + A_s)$

2. PRIMARY COMBUSTOR AIR IN-LEAKAGE (A_L)

3. PRIMARY AND SECONDARY NATURAL GAS $(G_p + G_s)$

4. STEAM FROM ASH QUENCH (S_A)

5. STEAM FROM SOIL MOISTURE (S_s)

6. SECONDARY COMBUSTOR INTERNAL FLOW VOLUME V

7. TEMPERATURE OF THE SECONDARY COMBUSTOR $(T_s$

8. SOIL FEED RATE $(F$

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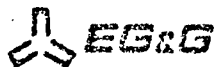
EG&G Idaho, Inc.
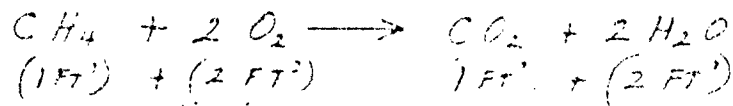
FORM EG&G-1382
(Rev. 5-77)

CALCULATION WORK SHEET

Subject: *SECONDARY COMBUSTOR RESIDENCE TIME* Date *8-25-87*

Prepared By ___C. W. DEIRO___ Checked _____ Work Request _____

THE BASIC RESIDENCE TIME EQUATION IS,

$$\Theta = \frac{V \; FT^3}{(G_P + G_S + A_P + A_S + A_L + S_A + S_S)\frac{Ft^3}{SEC}}$$

THE INTERNAL VOLUME OF THE SECONDARY

COMBUSTOR IS $V = 1,378.9 \; FT^3$

THE NATURAL GAS IS APPROXIMATELY 93% METHANE

WHICH WHEN COMBUSTED PRODUCES THE SAME

TOTAL VOLUME OF PRODUCTS AS THE REACTIVE

GASES.

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$
$$(1 \, FT^3) + (2 \, FT^3) \qquad 1 \, FT^3 + (2 \, FT^3)$$

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CALCULATION WORK SHEET

Subject: SECONDARY COMBUSTOR RESIDENCE TIME Date 8-25-87

Prepared By S. W. DEIRO _____ Checked _____ Work Request _____

THE VOLUMES OF NATURAL GAS AND AIR ARE

HEATED FROM AMBIENT TEMPERATURE (70°F) TO

THE SECONDARY COMBUSTOR OUTLET TEMPERATURE

WHICH IS DESIGNATED AS T_{SO}. THE IDEAL

GAS LAW WILL BE USED ASSUMING THAT THE

PRESSURE DOES NOT CHANGE SIGNIFICANTLY BETWEEN

THE PRIMARY AND SECONDARY COMBUSTORS.

NATURAL GAS VOLUME RATE OF FLOW;

$$\frac{FT^3}{SEC} = \frac{(G_p + G_s)\ SCFH}{3600\ \frac{SEC}{HR}} \left[\frac{T_o + 460}{70 + 460}\right]$$

THE COMBUSTION AIR VOLUME RATE OF FLOW,

$$\frac{FT^3}{SEC} = \frac{(A_p + A_s)\frac{lb}{HR}}{60\ \frac{SEC}{MIN}} \left(14.08\ \frac{FT^3}{lb_m}\right)\left[\frac{t_o + 460}{70 + 460}\right]$$

$$= .2348 \left(A_p + A_s\right) \frac{FT^3}{SEC} \left(\frac{t_o + 460}{530}\right)$$

CALCULATION WORK SHEET

Subject *SECONDARY COMBUSTOR RESIDENCE TIME*   Date *8-21-87*

Prepared By *S. W. DEIRO* _____ Checked _____ Work Request _____

THE AIR IN-LEAKAGE TERM

ASSUME 5% IN-LEAKAGE TO PRIMARY COMBUSTOR

$$\frac{FT^3}{SEC} = \frac{.05 \, A_p \, \frac{lb}{min}}{60 \, \left(\frac{SEC}{min}\right)} \left(14.087 \, \frac{FT^3}{lb}\right) \left[\frac{t_s + 460}{70 + 460}\right]$$

$$= .0117 \, A_p \left(\frac{t_s + 460}{530}\right) \frac{FT^3}{SEC}$$

THE STEAM PRODUCED FROM THE ASH QUENCH CAN BE CALCULATED FROM A HEAT BALANCE EQUATION (HEAT LOSS FROM ASH = HEAT GAIN BY H₂) THE HEAT BALANCE WILL BE SET UP USING THE FOLLOWING ASSUMPTIONS,

1. THE ASH DRAG WATER POOL STEADY STATE OPERATING TEMPERATURE IS 180°F

2. THE ASH TEMPERATURE IS 300°F HIGHER THAN THE KILN OUTLET TEMPERATURE.

3. THE ASH FLOW RATE IS 80% OF THE SOIL FEED RATE

Subject: SECONDARY COMBUSTOR RESIDENCE TIME   Date 8-26-87

Prepared By S. W. DEIRO _____ Checked _____ Work Request _____

4. THE SPECIFIC HEAT OF THE ASH IS THE

SAME AS THE SPECIFIC HEAT OF SAND $\left(C_p = .191 \frac{F}{Lb}\right)$

5. STEADY STATE OPERATING CONDITIONS AT
ESSENTIALLY ATMOSPHERIC PRESSURE.

HEAT BALANCE EQUATION

$$ASH\ HEAT\ LOSS = X\left(\frac{Lb\ of\ H_2O}{SEC}\right)\left[\begin{matrix}LATENT\ HEAT\\OF\ EVAPORATION\\@\ 14.696\ PSI\end{matrix} + \begin{matrix}HEAT\ CAPAC.\\OF\ H_2O\ AT\\CONSTANT\ P.\end{matrix}\right]$$

$$\frac{.8\ F\ \frac{Lb}{MIN}}{60\ \frac{SEC}{MIN}}\left(.191\ \frac{BTU}{Lb\ °F}\right)\left(t_p + 305 - 180\right) = X\left(\frac{Lb}{SEC}\right)\left[970.3\ \frac{BTU}{Lb} + 1.00763\ \frac{BTU}{Lb\ °F}\left(212 - \right.\right.$$

SOLVING FOR X,

$$X\left(\frac{Lb}{SEC}\right) = \frac{\dfrac{.8\ F\ (.191)\left(t_p - 120\right)}{60}}{970.3 + 1.00763\ (212 - 180)}$$

$$X = 0.00000254\ F\left(t_p + 120\right)\ \frac{Lb}{SEC}$$

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EG&G Idaho, Inc.

CALCULATION WORK SHEET

Subject _SECONDARY COMBUSTOR RESIDENCE TIME_ Date _8-26-87_

Prepared By _S. W. DEIRO_ Checked _____ Work Request _____

THE STEAM FROM THE SOIL MOISTURE,
ASSUME 5% OF SOIL WEIGHT IS H_2O

$$\frac{Lb}{SEC} = \frac{.05\ F\left(\frac{Lb}{MIN}\right)}{60\left(\frac{SEC}{MIN}\right)}$$

$$= 0.000233\ F\ \frac{Lb}{SEC}$$

THE STEAM MASS FLOW RATES MUST BE CONVERTED

TO VOLUME FLOW RATES AT THE SECONDARY

COMBUSTOR OUTLET TEMPERATURE (t_3).

FROM THE ASME STEAM TABLES.

A~ 14 PSIA

°F	FT^3/Lb	$\Delta\ FT^3/Lb$
1,500	83.366	
1,400	___ __.___	4.255
1,400	79.108	
1,300	74.849	4.259
1,200	70.589	4.260
1,100	66.329	4.260

CALCULATION WORK SHEET

Subject _SECONDARY COMBUSTOR RESIDENCE TIME_   Date _5-26-87_

Prepared By _S. W. DEIRO_   Checked _____ Work Request _____

THE ASME STEAM TABLES DO NOT HAVE DATA

FOR THE SECONDARY COMBUSTOR TEMPERATURE

RANGE ($2,100°F - 2,500°F$) THEREFORE THE STEAM

SPECIFIC VOLUME WILL BE EXTRAPOLATED FROM

THE BASE VALUE AT $1,100°F$.

FOR STEAM,

$$Sp. Vol \ FT^3/lb = 66.529 + .0426 \left(\frac{FT^3/lb}{°F}\right)(t_s - 1100)$$

THE RESIDENCE TIME EQUATION NOW BECOMES;

$$\theta(sec) = \frac{V (FT^3)}{\left(\frac{t_o + 460}{520}\right)\left[\frac{G_p + G_s}{3600} + .2348(A_p + A_s) + .0117 A_p\right]\left(\frac{FT^3}{SEC}\right)} + \left[66.529 + .0426(t_s - 1100)\right]\left[.0000254 \ F(t_o + 120) + .000533 F\right]$$

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CALCULATION WORK SHEET

Subject _SECONDARY COMBUSTOR RESIDENCE TIME_ Date _7-26-87_

Prepared By _S. W. DEIRO_ _____ Checked _____ Work Request _____

COMBINING TERMS WE HAVE,

$$\theta = \frac{1,378.9}{\left(\frac{t_s+460}{530}\right)\left(\frac{G_p+G_s}{3600} +.2465 A_p +.2348 A_s\right) + \left[66.329 +.0426(t_s-1100)\right]\left[.000833 +.00000254 F(t_p+120)\right]}$$

FOR THE FOLLOWING PARAMETERS THE RESIDENCE

TIME IS CALCULATED TO BE 2.074 SEC.

$t_p = 1700\ °F$ $F = 5\ TON/HR = 166.67\ Lb/MIN$

$t_s = 2200\ °F$ $G_p = 11,392\ SCFH$

$G_s = 22,500\ SCFH$ $A_p = 145\ Lb/MIN$

$A_s = 285\ Lb/MIN.$

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APPENDIX F

TRANSMITTAL OF RESPONSE TO EPA REGION IV TRAIL BURN QUESTIONS

Appendix F contains the EPA questions and information requests concerning the RCRA Trial Burn Report. The EG&G responses are briefly summarized. Detailed information was contained in several appendices to the original document that was transmitted to EPA Region IV but is omitted from this report because of its voluminous nature and because it would not significantly increase the reader's understanding of trial burn reporting. The body of the letter is presented to give the reader an understanding of the types of questions asked by EPA Region IV.

This appendix was reproduced from the best available copy. The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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INEL

Idaho National Engineering Laboratory

September 9, 1987

Ms. Carone Falconer
EPA Region IV
345 Courtland St, NE
Atlanta, GA 30365

TRANSMITTAL OF RESPONSE TO EPA TRIAL BURN QUESTIONS

Dear Ms. Falconer:

Attached for your review and approval is a draft response to
Mr. Patrick P. Tobin's request to Major T. L. Stoddart for additional
information concerning the trial burn report.

We are planning to meet with you during the week of September 14 to
discuss the auger speed questions and any other outstanding issues.

If you have any questions, please call me at (208) 526-9959 or at NCBC
(601) 864-4139.

                          Very truly yours,

                          Daniel J. Haley

                          Daniel J. Haley
                          Senior Program Specialist
                          Hazardous Waste Programs

la

Attachment:
As Stated

cc: R. Abramo, Ensco
     D. M. Knudson, Ensco
     B. A. Reiter, Ensco
     T. L. Stoddart, Major, USAF/RDVW
     J. O. Zane, EG&G Idaho (w/o Attach.)

EG&G Idaho Inc   P.O. Box 1625   Idaho Falls, ID 83415

EG&G IDAHO, INC

DRAFT

RESPONSE TO EPA REGION IV
COMMENTS ON NCBC TRIAL BURN REPORT

SEPTEMBER 9, 1987

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The EPA Region IV requests for information are included and preface each
EG&G response.

1. [Please provide the following:] More complete information from the
    analytical laboratory. Specifically, raw data (e.g., weights,
    dilutions, day to day operations,) laboratory chain of custody
    procedures, GC/MC logs, and summary reports of QAM or QCC inspections
    are needed.

    Appendix A to this document includes copies of project login

    sheets,QC review lists, nonconformance memos, sample prep worksheets,

    group test assignment sheets, and GC/MS run logs. In addition,

    copies of the IT Analytical Services Corp.'s standard operating

    procedures for coding, sample tracking, and GC/MS review.

2. Because DRE calculations and other reported results were based on
    nondetect levels found in the various sample matrices, the
    assumptions and calculations performed in the determining the minimum
    detection limits must be presented.

    Attached as Appendix B is a description of the method by which the

    reported detection limits were documented. Also included is the raw

    data which was used to perform these calculations. The GC/MS

    chromatograms were presented in the trial burn report but are

    resubmitted here for your convenience.

3. Section 12.2.5A of the QAP specifies that at least two clean XADs and
    at least two clean filters should be spiked with the POHCs to
    determine percent recovery. Accuracy values for these spiked samples
    were not found in the data packet summary tables.

    The spiked blanks were prepped and analyzed with the samples. The

    data was submitted with the raw data package but the results were

    omitted from the final report. The XAD summary page has been amended

    to include the blank data and is attached as Appendix C. The raw

    data is also included.

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4. Sections 12.2.1A of the QAP specifies the analysis of at least one
    performance sample to assess the accuracy of the instrumental
    procedure. It is unclear whether this QC check was performed.

    The intent of section 12.2.1A of the QAP was to assess the

    concentration of POHC in the feedstock sand. Extensive problems were

    encountered with mixing the POHC with the clean sand in the cement

    mixer as originally proposed in the Trial Burn Plan. Therefore, it

    was proposed to, and approved by EPA Region IV staff that the POHC be

    added directly to the feed auger in discrete quantities. The

    proposal, which was submitted in the Trial Burn Report, is

    resubmitted as Appendix D.

    Because the POHC was added directly to the feed auger, there was not

    need for a performance sample.

5. Section 12(B).4 of the QAP specifies that control charts be generated
    from check standards run every 8 hours; the analytical report from
    ITC indicates that a continuing calibration standard was analyzed
    every 12 hours. Please clarify this discrepancy.

    Both EPA SW-846 Method 8270 and the EPA CLP Statement of Work

    specified a 12 hour calibration period. An error was made in the

    writing of the QAP; 12 hours not 8 hours, should have been specified.

2

6. In the trial burn report, Table 1 (page v) lists the Modified Method
    5 trains analytical detection limit as 0.01 ug/dscf. This claim is
    misleeding, since a sampling train's detection limit i.e., estimated
    typically as a mass value (e.g.. 1 ug, etc.). As noted in the
    comment above, further discussion of detection limits is needed.

    The overall detection limit listed in Table 1 for the Modified
    Method 5 is a function of the analytical detection limit for the
    XAD resin and the volume of gas sampled and is given by:

    Overall Detection = {XAD Detection / Gas Volume Sampled}

    The detection limits for the XAD was presented in the Trial Burn
    Report (Appendix E, Exhibit 1) and is presented in Table 1,
    below. The volume of gas sampled which was presented in the
    Trial Burn Report (Appendix D, Exhibit 8) is also shown below.

Table 1
NCBC Trial Burn Detection Limit Summary

Run	XAD Detection Limit HCE ug	TCB ug	Volume Gas Sampled DSCF	Overall Detection HCE ug/DSCF	TCB ug/DSCF
7A	1^U	0.14^J	125.812	0.01	0.001
7B	1^U	0.25^J	128.751	0.01	0.002
7C	1^U	1^U	132.58	0.01	0.01

U   Indicates the compound was analyzed for but not detected. The
    numerical value is the quantitation limit.

J   Indicates an estimated value. The mass spectral data indicates
    the presence of a compound but the result is less than the
    quantitation limit but greater than zero.

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7. Theoretical calculations of the maximum volume the auger will
    deliver at given rpms. The data should also be plotted on a
    graph (volume vs. rpms) for the 5-6 rpm range using only the
    number of decimal places consistent with the accuracy of the
    auger speed controller. Also, please submit the density of the
    trial burn sand and the native soil.

    A response to this question will be presented in person at a meeting
    between EG&G, Ensco, the USAF and the EPA on Friday,
    September 11, 1987.

8. The data used to develop the graphs and the averages listed in the
    tables. When you compare the sand feed rate averages on pages 21 and
    the graphs on page 26, they do not appear to agree. Several other
    parameters also do not seen to closely correlate. The information
    submitted may influence some of the numbers recommended for permit
    conditions.

    The data was re analyzed and the average values listed in Table
    4-1, page 21 of the Trial Burn Report are correct. The data are
    listed in Table 2.

    The graphs shown as Figures 4-2 and 4-3 in the TRB have been
    reformatted and are attached as Figures 1 through 6 the time
    scale was adjusted to facilitate review. The maximum, minimum,
    mean, and standard deviation data stated in Table 2 reflect the
    data obtained during the test times indicated.

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Table 2
NCBC Trial Burn
Sand Feed Rate Summary

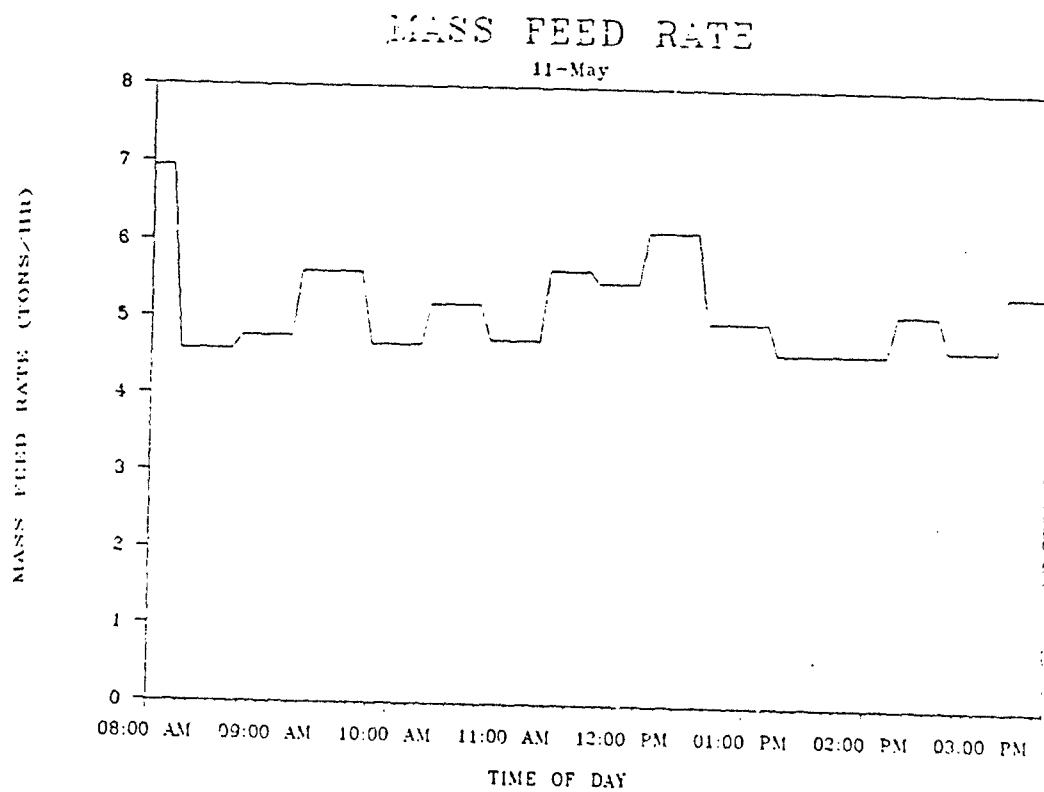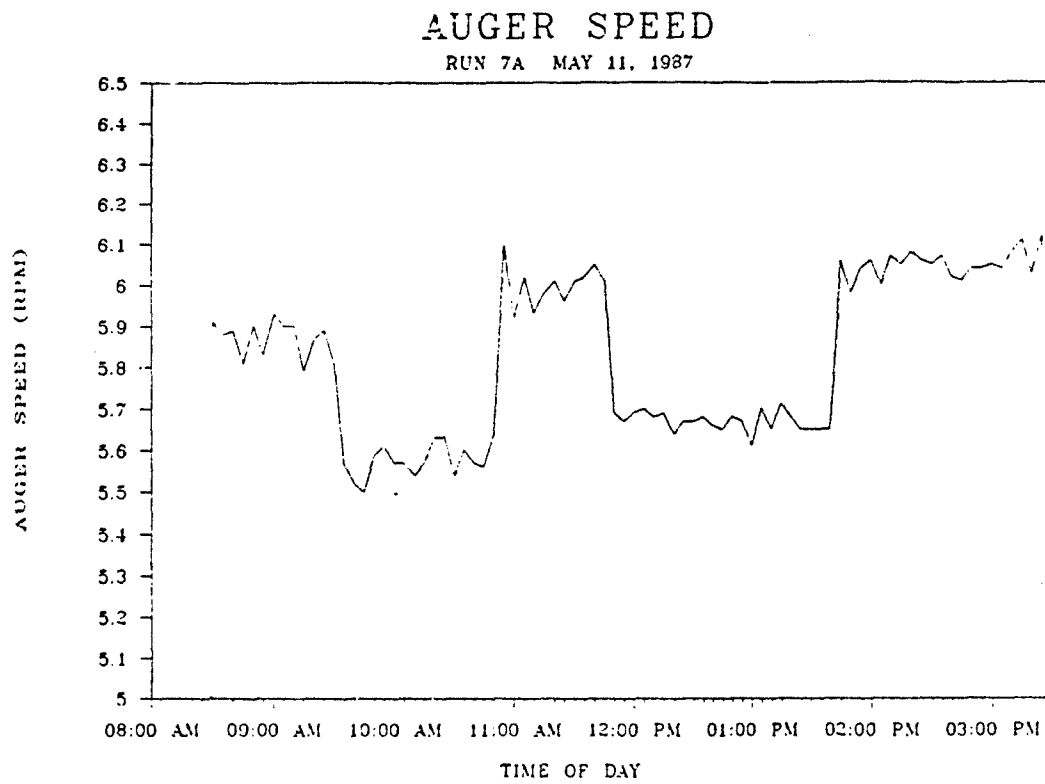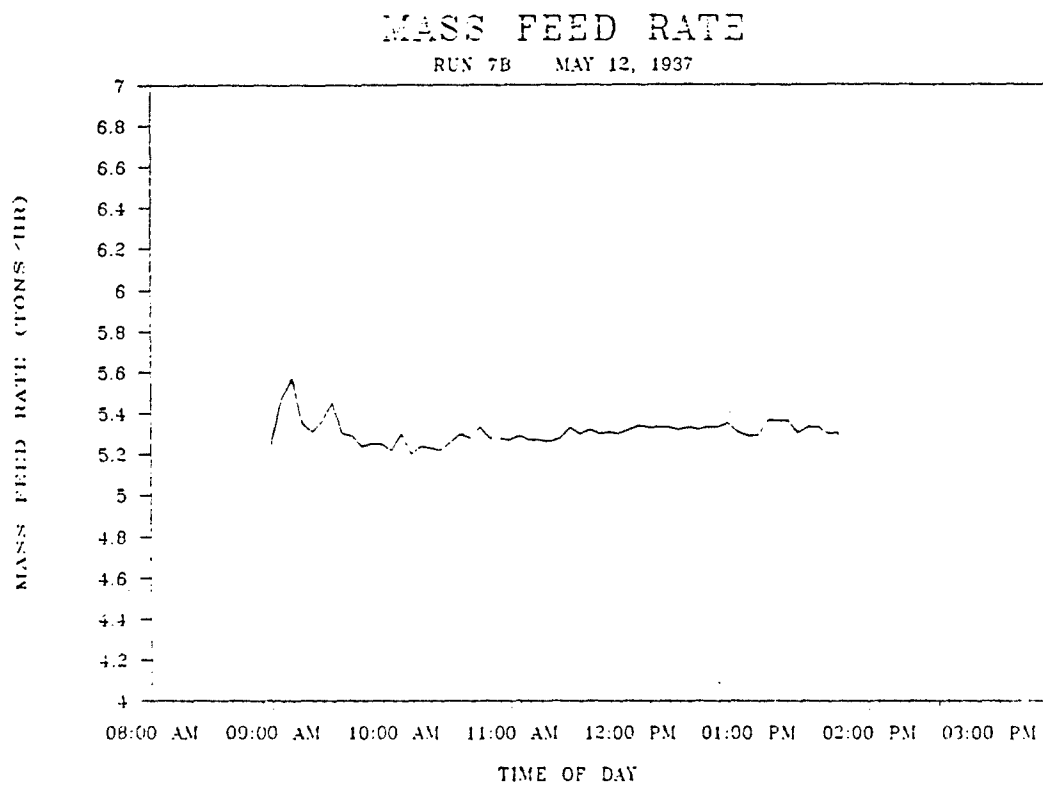|	7a 5/11/87	7b 5/12/87	7c 5/16/87
Sand Feed Rate (Tons/hr)			
Average	5.1	5.3	5.3
Maximum	6.9	5.6	5.4
Minimum	4.6	5.27	5.17
Standard Deviation	0.6	0.1	0.05
Auger Speed (rpm)			
Average	5.82	5.80	5.95
Maximum	6.11	5.89	6.04
Minimum	5.50	5.71	5.88
Start Time	08:00	08:50	08:20
Finish Time	15:15	13:35	13:10

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MASS FEED RATE

11-May

Figure 1

AUGER SPEED

RUN 7A   MAY 11, 1987

Figure 2

MASS FEED RATE

RUN 7B   MAY 12, 1937

Figure 3

AUGER SPEED

RUN 7B   MAY 12, 1987

Figure 4

MASS FEED RATE

MAY 16, 1987   TEST 7C

Figure 5

AUGER SPEED
MAY 16, 1987   TEST 7C
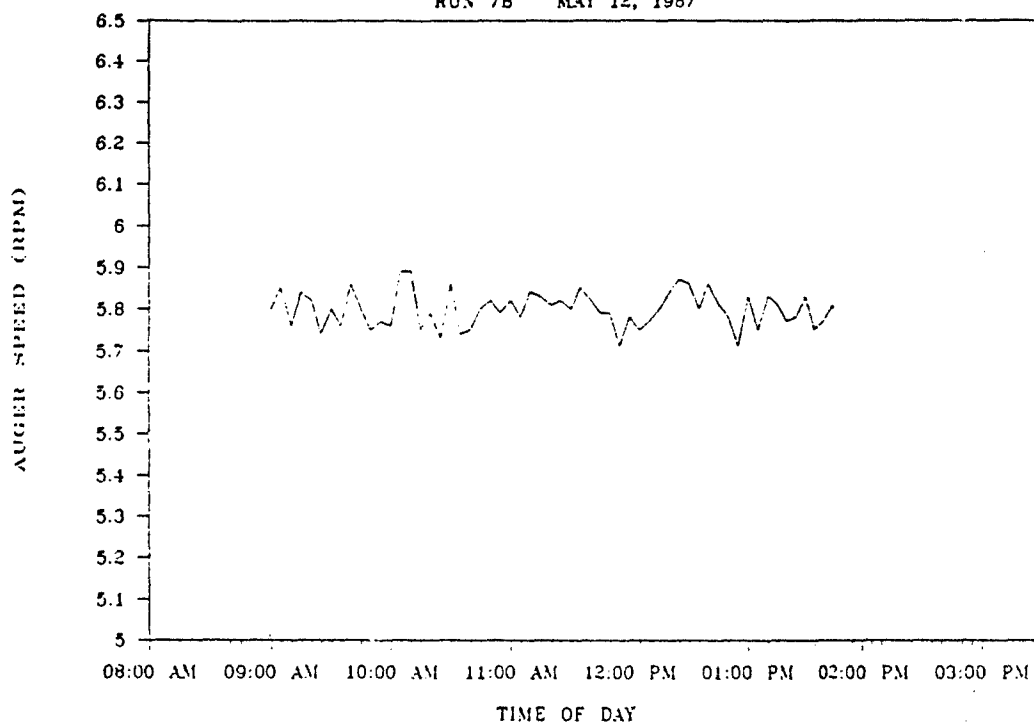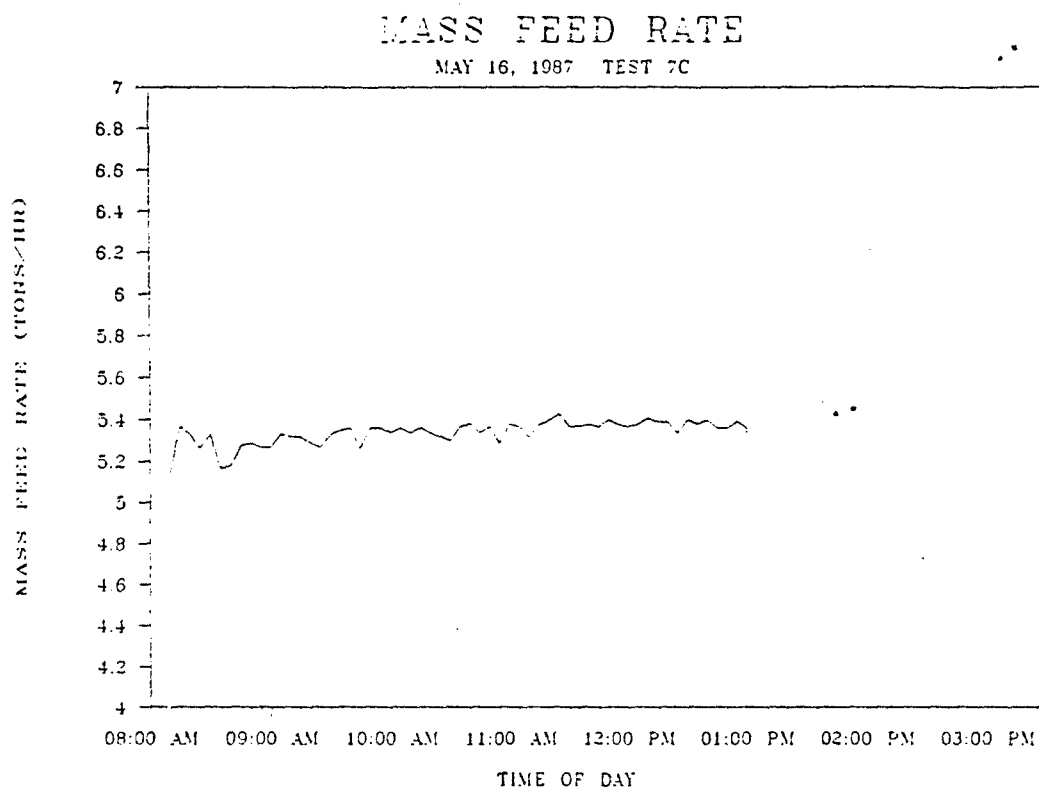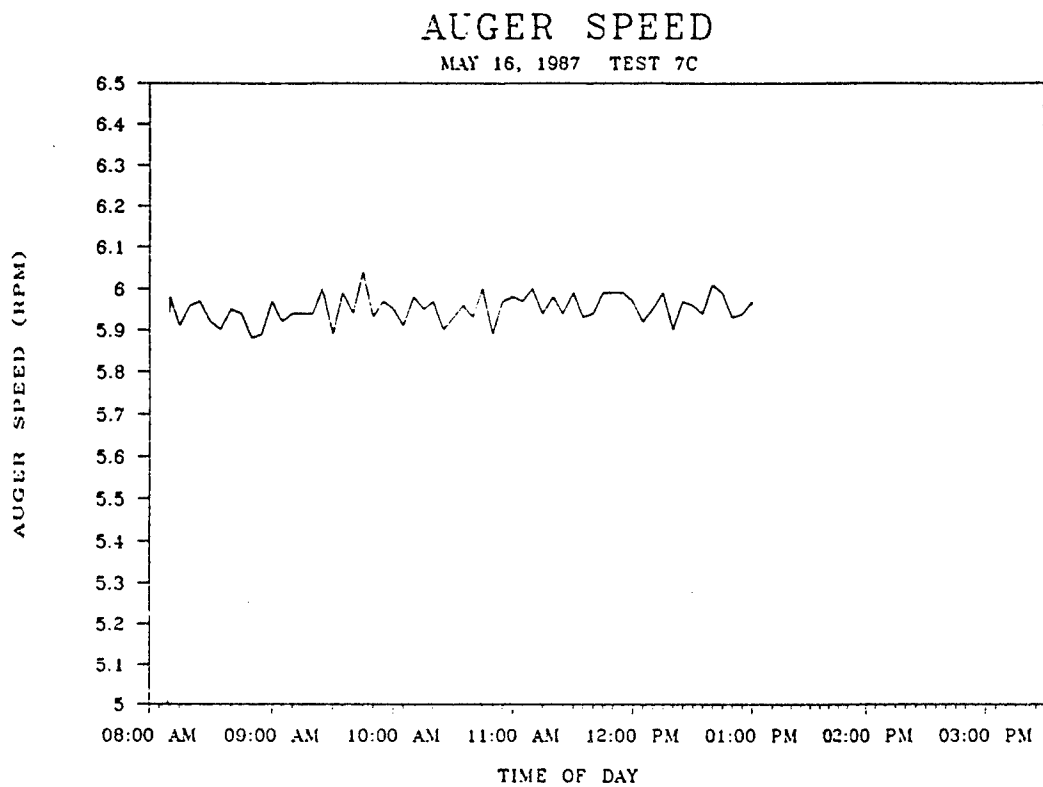
Figure 6

9. The DAS formula for calculating the SCC residence time.

The DAS formula for calculating residence time is :

where:

A_p= primary (kiln) combustion air, lbs/min

A_s= secondary combustion air, lbs/min

A_1= primary (kiln) combustion air resulting from air in-leakage around the kiln seals, lbs/min.

t_p= Temperature of the primary chamber at the exit, Deg F.

t_s= Temperature of the secondary combustion chamber at the exit, Deg F.

F = Mass feed rate of sand to the kiln, lbs/min

G_p= Natural gas feed rate to the kiln, SCFH

G_s= Natural gas feed rate to the secondary combustor, SCFH

V_s= Volume of the Secondary combustor, 1378.9 ft^3

A complete explanation of this equation and errors in the equation submitted in the Trial Burn Report was transmitted to EPA Region IV on September 2, 1987. It is resubmitted as Appendix E.

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10. The DAS data on the ejector scrubber nozzle control parameters (raw data and graphs), i.e., steam pressure, draft and recirculation flow rate.

    The requested data is presented as Appendix F.

11. The CO strip charts and DAS data for the December verification soil tests.

    The CO strip charts for the December Verification Tests are presented as Appendix G. The DAS data summary for the December Verification tests is presented in Table 3.

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SUMMARY OF
INCINERATOR OPERATING CONDITIONS

PARAMETER	TEST 1	TEST 2	TEST 3	TEST 5	TEST 6
DATE	12/06/86	12/07/86	12/07/86	12/15/86	12/15/86
START TIME	13:39	09:45	14:55	09:20	11:45
FINISH TIME	14:55	11:00	16:05	10:30	12:55
KILN MAX TEMP (DEG F)	1661	1449	1642	1624	1418
KILN MIN TEMP (DEG F)	1630	1332	1440	1391	1315
KILN AVG TEMP (DEG F)	1645	1377	1552	1485	1355
KILN MIN PRESSURE (IN. H2O)	-9.64	-0.37	-0.44	-0.43	-0.39
KILN MAX PRESSURE (IN. H2O)	-0.15	0	-0.14	-0.36	-0.23
KILN AVG PRESSURE (IN. H2O)	-2.1	-0.2	-0.25	-0.39	-0.33
SCC MAX TEMP (DEG F)	2184	2184	2187	2168	2118
SCC MIN TEMP (DEG F)	2161	2137	2128	2090	2091
SCC AVG TEMP (DEG F)	2171	2159	2167	2113	2101
SCC MIN PRESSURE (IN. H2O)	-2.15	-2.27	-2.37	-2.70	-2.51
SCC MAX PRESSURE (IN. H2O)	-1.68	-1.62	-1.95	-2.36	-2.12
SCC AVG PRESSURE (IN. H2O)	-2.00	-1.92	-2.09	-2.51	-2.26
AVERAGE SOIL FEED RATE (TONS/HR)	2.82	3.64	3.71	5.22	6.31
COMBUSTION EFFIEICNCY CO2%/(CO% + CO2%)	100.0%	100.0%	100.0%	100.0%	100.0%

Table 3

12. The graphs for the soil feed rates and auger rpms re-done using .the same time increments so that the data can be compared.

See Figures 1 through 6 in the responce to question 8.

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APPENDIX G

TRANSMITTAL OF RESPONSE TO EPA TECHNICAL ISSUES III AND RELATED CORRESPONDENCE

Appendix G contains the EPA questions and information requests concerning various technical issues, in particular the SCC gas residence time is discussed. This appendix was reproduced from the best available copy.

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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INEL

Idaho National Engineering Laboratory

EG&G Idaho, Inc.
Gulfport Field Office
NCBC Code Orange
Gulfport, MS 39501

October 19, 1987

Ms. Carone Falconer
EPA Region IV
345 Cortland S:. NE
Atlanta, GA 30365

TRANSMITTAL OF RESPONSE TO EIA TECHNICAL ISSUES III   DJH-18-87

Dear Ms. Falconer:

Attached are four copies of EG&G Idaho's response to EPA's letter
of September 23, 1987.

The equipment and software changes necessitated by these responses
have been incorporated into the incinerator system. Additionally,
the following instruments have been linked to continuous strip
chart recorders per the memo of B. Willis to you, dated August 17,
1987:

>   auger speed indicator
>   SCC temperature
>   packed tower scrubber water flow rate
>   ejector scrubber recirculation flow rate
>   stack carbon monoxide
>   kiln draft

The SCC residence time strip chart will be installed this week.

As part of the response to question 7, Ensco developed a more
accurate residence time equation. The derivation of that equation
is included in the attached response. If you have any questions
concerning the derivation or validity of that equation, or any
other issues, please call me at the NCBC field office (601)
864-4139. If appropriate, we would be happy to meet with you in
your Atlanta offices this week.

EG&G Idaho, Inc.   P.O. Box 1625   Idaho Falls, ID 83415

We look forward to your prompt review and approval to commence operations.

Very truly yours,

Daniel J. Haley
Sr. Programs Specialist
Hazardous Waste Programs

Attachments:
As Stated

cc: Maj. T. Stoddart USAF/AFESC
       B. C. Willis EPA Region IV
       J. O. Zane EG&G Idaho (w/o attach)

DEPARTMENT OF THE AIR FORCE

HEADQUARTERS AIR FORCE ENGINEERING AND SERVICES CENTER

TYNDALL AIR FORCE BASE FL 32403-6001

                                    17 OCTOBER, 1987

Reply to attn of : RDVW (Maj Stoddart)

Subj: Letter of Transmittal; Response to Your Letter Dated
      23 September, 1987.

To: Ms Caron Falconer
    EPA, Region IV
    345 Courtland Street
    Atlanta, Georgia   30365

1. Please find enclosed a certified copy of the Air Force final
Response to questions posed by EPA in the referenced letter
(attached). It is my understanding that there are no other issues
requiring an Air Force Response.

2. Should you wish to discuss the enclosed response, please
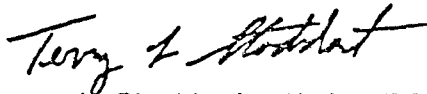contact me at the NCBC field office, tele; 601-864-4139.

Terry L Stoddart

Terry L Stoddart, Maj, USAF, BSC
Chief, Environmental Restoration R&D

CERTIFICATION STATEMENT

REQUIRED BY 40 CFR 270.11 (d)

I certify under penalty of law that this document and all
attachments were prepared under my direction or supervision
in accordance with a system designed to assure that
qualified personnel properly gather and evaluate the
information submitted. Based on my inquiry of the person or
persons who manage the system, or those persons directly
responsible for gathering the information, the information
is, to the best of my knowledge and belief, true, accurate,
and complete. I am aware that there are significant
penalties for submitting false information, including the
possibility of fine and imprisonment for knowing
violations.

Terry L Stoddart, Maj, USAF, BSC
CH, Environmental Restoration R&D

DATE: 17 OCTOBER, 1987

RE: RCRA Permit NO. MS 2 170 022 626

EG&G Idaho,Inc.
Response to
EPA Technical Issues at NCBC
Gulfport, MS

October 19, 1987

1. The theoretical calculations for the maximum volume the auger
   will deliver at given rpms must be corrected. This is in
   response to question 7 of EPA's letter dated August 18, 1987.
   The calculations submitted show 4.36 tons/hr at 5.8 rpms.
   However, the actual value observed during the trial burn was 5.3
   tons/hr at 5.8 rpms. As discussed, the calculations for
   theoretical volume and/or bulk density should be checked.

   The calculations for theoretical maximum volume the auger will

   deliver have been investigated. The mathematics are correct; the

   bulk density of the surrogate burn sand at 71.1 pounds per cubic

   foot was for loose sand. The sand, as any soil, compacts as it

   travels through the auger. Fully compacted sand has a bulk

   density of 98 pounds per cubic foot or higher. To deliver 5.3

   tons/hr at 5.8 rpm, the bulk density of the sand in the auger

   would have to be only 88.53 pounds per cubic foot.

   The recommendations in the response to question 7 of EPA's August

   18, 1987 letter will resolve the issue. The settings proposed to

   limit auger speed are conservative, based on existing data, and

   will provide protection during the several weeks of acquiring

   auger speed and bulk feed rate data.

2. An explanation or correction for the number of spikes done under
   Section 12.25A of the QAP must be provided. This is in response
   to question 3 of EPA's August 18, 1987, letter. The QAP lists
   four (4) spikes, however, we could only find two (2) in your
   response. Please explain or correct this discrepancy.

   The extractant from the clean filters was composited with the

   extractant from the XAD. This composited extractant was then

   spiked with a known quantity of POHC to determine the percent

   recovery. Although two separate filters and two separate XAD

   modules were extracted, only two extractant composites were

   analyzed. The data from that analysis was provided in the

   September 9 transmittal to EPA.

3. The data from the June 29-30 TRV event simulation showing the
    change in SCC temperature versus time must be provided. This is
    in response to question 2 of EPA's June 9, 1987, letter.

    The data for the TRV event, actually performed on August 31 at

    12:17 PM, is shown in Attachment 1. Copies of the strip charts

    from this staged test are included. The data tabulated was

    manually recorded from digital temperature readouts every 3

    minutes as the test progressed. A graph showing the incinerator

    and secondary combustor temperature as a function of time is

    provided to supplement the strip charts.

4. Your response to question 2 of EPA's letter dated June 9, 1987,
    must be changed to state that the SCC flame and temperature will
    be maintained during a TRV event until all solids exit the kiln.

    The SCC and incinerator burners will remain on as necessary to

    maintain a SCC chamber in excess of 2150°F for at least 20

    minutes (see response to question 5 below) after the TRV event or

    until the TRV event is terminated.

5. The retention time for kiln solids at 4.5 rpms must be provided.
    The retention time will determine how long flame must be
    maintained in the SCC during a TRV event. (Question 2, EPA's
    June 9, 1987, letter.).

    The retention time for solids in the kiln while operating at 4.5 rpm

    is 20 minutes. The retention time was obtained by noting the time

    duration between the stopping of the auger feed and the cessation of

    kiln solids falling into the ash quench. The moment of cessation was

    observed visually through a view port located above the ash quench.

    It is impossible, however, to remove more than 80% of the kiln solids

    because of the refractory dams in the kiln. This data was taken from

    the staged test run August 31, 1987, and referenced in item 3 above.

6. The time needed for the diesel generator to restore power during a power failure must be provided. Also, the length of time that the incinerator can operate with the diesel generator and confirmation that full operation can be maintained must be provided. (Question 2, EPA's June 9, 1987, letter.)

    The time required to start the diesel generator and restore power is normally under 3 minutes and is not expected to exceed 5 minutes. The incinerator can operate with the diesel generator indefinitely; although as a matter of policy, soil feed would terminate with the loss of commercial power and would not resume until commercial power was restored.

7. The correct moisture content for solids to the kiln must be provided in the combustion gas velocity calculation. Also, the correct heat capacity value and the contribution from combustion of kiln solids and/or organics must be added to the calculation. (Questions 4, EPA's June 9, 1987, letter).

    A equation for determining the residence time in the secondary combustor was submitted in the trial burn report. A more detailed and explained equation was submitted in the September 2, 1987 transmittal to EPA. That equation calculated the residence time based upon the natural gas flow rate, the combustion air input, and several assumed values.

    Recent questions received from the EPA prompted a reevaluation of the previously submitted residence time equation. Certain inherent inaccuracies in the assumptions upon which the residence time was based were discovered. Therefore, the residence time equation was re-developed and is correctly given by:

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$$RT = \cfrac{(1378.9 \ FT3)\ (3600 \ SEC/HR)}{\left(\cfrac{T_{scc}+460}{520}\right)\left[CH_4 + \left(\cfrac{CH_4 \cdot O_2 \cdot 2}{21-O_2}\right) + \left(\cfrac{CH_4 \cdot 158.0}{21-O_2}\right) + \left(CH_4 \cdot 2\right)\right] + \left(\cfrac{T_{scc}+460}{672}\right)\left[\left(\cfrac{S \cdot M \cdot 26.799}{100}\right) + \left(S \cdot .23 \cdot \cdot 26.799\right)\right]}$$

EQUATION 1

where

S = solids feed rate, lb/hr

M = soil moisture content, percent

T_{scc} = Secondary combustor temperature, deg F.

CH_4 = Natural gas flow rate in both the kiln and the SCC, SCFH

O_2 = Oxygen Content of the stack gas, percent

1378.9 = Internal volume of the SCC

The derivation of equation 1 is presented as Attachment 2.

Equation 1 is believed to be significantly more accurate than any previously submitted equation because it does not have any assumed values; all of the variables are measured, including soil moisture content.

Equation 1 shows that the residence time is inversely proportional to the soil moisture content. At a given set of thermal conditions, as the moisture content increases, lower feed rates are required to maintain the minimum residence time specified by the permit. In an effort to keep the feed rate as high as possible without violating the permit specified residence time, the correct soil moisture content

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must be input into the residence time equation. Therefore, EG&G proposes to measure the moisture content of the feedstock soil at least once every operating shift by using a direct reading device. The operator will input the measured soil moisture content into the DAS equation as a keyboard entry. The entry will be verified by the shift supervisor.

As a quality control effort, the DAS will print out the soil moisture content as part of the 15 minute data printouts. Additionally, the operational logbook will include an entry for soil moisture content. EG&G personnel will check the logbook entries against the DAS printout to assure accuracy and consistency.

The direct measuring device will be calibrated according to the manufacturers instructions. The results of the calibration will be kept in the aforementioned logbook.

Other Processed Organics

EG&G analyzed the potential contribution of organics to the residence time equation. A worst case approach was taken by assuming that the feedstock soil contained 2.08% by weight of 2,4,Dichlorophenoxyacetic Acid (2,4-D) and 2.77% by weight of 2,4,5- Trichlorophenoxyacetic acid (2,4,5-T) which are the two primary components of herbicide orange. Those concentrations were chosen base upon the maximum concentrations reported in the Herbicide Orange Site Characterization Study report (Reference 1). The average total concentration of herbicides in the samples analyzed for the site characterization study was 117 ppm.

The calculations show that the presence of 4.8% by weight of herbicides in the feedstock would decrease the residence time by only 2%. The calculations are presented as Attachment 3.

Reference 1: EG&G Idaho Inc. Herbicide Orange Site Characterization
                Study Naval Construction Battalion Center, Idaho Falls, ID
                1987

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Because the residence time is negligibly affected and because the actual concentration of herbicides would be much lower than assumed in these calculations, the contribution of herbicides was not included in the residence time equation.

Proposed Residence Time Limit

Equation 1 was applied to the conditions observed during the trial burn. Tables 7-1 through 7-3 list the conditions observed on the dates indicated. The averages listed are the averages for the time period of the trial burn stack test. Figures 7-1 through 7-3 show the calculated residence time for the dates indicated.

Based upon the observed data and the calculated residence time using equation 1 above, EG&G Idaho and Ensco respectively propose that the permit condition for the residence time be set at 1.60 seconds. We further propose that the automatic waste feed shut off system be activated at 1.60 seconds and that a warning alarm be activated at 1.62 seconds.

TABLE 7-1

NCBC FULL SCALE DEMONSTRATION
TRIAL BURN DATA
RESIDENCE TIME CALCULATION REPORT WORKSHEET
RUN 7A

SAND MOISTURE CONTENT   5.6 PERCENT
TEST START TIME: 08:30 AM
TEST FINISH TIME: 03:15 PM

STATISTICS LISTED ARE CORRESPOND TO THE TEST TIMES LISTED ABOVE

DATE	TIME	KILN NAT GAS (SCFH) **	KILN OUT TEMP (F)	SCC NAT GAS (SCCFH)	TOTAL NATURAL GAS FLOW (SCFH)	SCC OUT TEMP (DEG F)	STACK OUT O2 (%)	MASS FEED RATE (TONS/HR)	RETENTION TIME (SEC)
AVERAGE VALUE:		1441	1455	23177	37585	2156	5.82	5.07	1.66
MAXIMUM VALUE:		1500	1479	23846	38479	2172	6.51	6.16	1.74
MINIMUM VALUE:		1369	1431	22571	36351	2147	5.18	4.58	1.60
ST.DEV:		68.0	10.2	269.0	842.4	6.8	0.28	0.92	0.05
11-May	08:00 AM	1397	1462	22937	36007	2162	6.02	6.95	1.64
11-May	08:05 AM	1299	1456	22659	35649	2152	6.03	6.95	1.66
11-May	08:10 AM	1318	1452	22864	36044	2154	5.45	6.95	1.69
11-May	08:15 AM	1333	1464	22578	35908	2158	5.63	4.58	1.77
11-May	08:20 AM	1341	1457	22783	36193	2153	5.66	4.58	1.76
11-May	08:25 AM	1332	1457	22424	35744	2156	5.39	4.58	1.80
11-May	08:30 AM	1385	1457	22957	36707	2159	5.73	4.58	1.72
11-May	08:35 AM	1378	1451	22571	36351	2150	5.81	4.58	1.74
11-May	08:40 AM	1362	1450	22739	36559	2148	5.89	4.58	1.72
11-May	08:45 AM	1362	1451	23260	37080	2157	5.83	4.76	1.69
11-May	08:50 AM	1377	1447	23238	37008	2153	5.86	4.76	1.70
11-May	08:55 AM	1403	1441	23252	37282	2156	5.77	4.76	1.69
11-May	09:00 AM	1400	1440	23003	37003	2155	6.02	4.76	1.69
11-May	09:05 AM	1404	1440	23223	37263	2159	5.91	4.76	1.68
11-May	09:10 AM	1454	1457	22942	37382	2153	5.35	4.76	1.68
11-May	09:15 AM	1467	1462	23311	37981	2159	5.73	5.60	1.64
11-May	09:20 AM	1452	1456	22586	37106	2152	5.88	5.60	1.66
11-May	09:25 AM	1458	1453	23362	37942	2156	5.78	5.60	1.64
11-May	09:30 AM	1451	1459	23032	37542	2158	5.90	5.60	1.64
11-May	09:35 AM	1431	1461	23120	37430	2158	5.88	5.60	1.64
11-May	09:40 AM	1432	1463	22864	37184	2153	5.74	5.60	1.67
11-May	09:45 AM	1440	1464	23209	37608	2157	5.86	5.60	1.64
11-May	09:50 AM	1373	1451	22920	36550	2156	6.05	4.66	1.70
11-May	09:55 AM	1375	1449	23128	36878	2155	6.15	4.66	1.68
11-May	10:00 AM	1396	1456	23013	36978	2154	6.00	4.66	1.69
11-May	10:05 AM	1423	1448	23164	37394	2153	6.18	4.66	1.65

** NOTE: THE ACTUAL KILN NATURAL GAS FLOW IS 10 TIMES THE VALUE INDICATED AS REPORTED IN THE
          TRIAL BURN REPORT. THE TOTAL NATURAL GAS FLOW INCLUDES THIS FACTOR.

DATE	TIME	KILN NAT GAS (SCFH) **	KILN OUT TEMP (F)	SCC NAT GAS (SCCFH)	TOTAL NATURAL GAS FLOW (SCFH)	SCC OUT TEMP (DEG F)	STACK OUT O2 (%)	MASS FEED RATE (TONS/HR)	RETENTION TIME (SEC)
11-May	10:10 AM	1429	1459	23025	37315	2158	5.76	4.66	1.69
11-May	10:15 AM	1426	1465	22945	37205	2156	5.95	4.66	1.68
11-May	10:20 AM	1422	1461	23128	37348	2156	5.92	5.19	1.66
11-May	10:25 AM	1390	1459	23032	36932	2154	6.05	5.19	1.67
11-May	10:30 AM	1425	1456	23025	37275	2153	6.05	5.19	1.65
11-May	10:35 AM	1421	1456	23054	37264	2149	6.33	5.19	1.63
11-May	10:40 AM	1418	1457	23047	37227	2155	5.95	5.19	1.66
11-May	10:45 AM	1418	1461	22879	37059	2151	6.16	5.19	1.65
11-May	10:50 AM	1410	1462	23069	37169	2153	6.16	4.73	1.66
11-May	10:55 AM	1385	1451	23047	36897	2151	6.50	4.73	1.64
11-May	11:00 AM	1388	1443	23069	36949	2156	6.28	4.73	1.66
11-May	11:05 AM	1400	1441	23120	37120	2149	6.51	4.73	1.63
11-May	11:10 AM	1406	1431	23472	37532	2151	6.21	4.73	1.64
11-May	11:15 AM	1402	1438	22871	36891	2147	6.41	4.73	1.65
11-May	11:20 AM	1500	1437	23150	38150	2151	5.82	5.64	1.63
11-May	11:25 AM	1500	1448	23223	38223	2150	5.90	5.64	1.62
11-May	11:30 AM	1500	1458	23479	38479	2157	5.76	5.64	1.61
11-May	11:35 AM	1500	1461	23164	38164	2154	5.93	5.64	1.61
11-May	11:40 AM	1500	1465	23362	38362	2160	5.57	5.64	1.63
11-May	11:45 AM	1500	1467	23355	38355	2161	5.75	5.49	1.62
11-May	11:50 AM	1500	1464	23413	38413	2162	5.79	5.49	1.62
11-May	11:55 AM	1500	1471	23113	38113	2159	5.73	5.49	1.63
11-May	12:00 PM	1450	1459	23245	37745	2163	6.02	5.49	1.62
11-May	12:05 PM	1451	1462	23252	37762	2155	5.91	5.49	1.63
11-May	12:10 PM	1451	1456	23347	37857	2162	5.79	6.16	1.62
11-May	12:15 PM	1445	1456	23084	37534	2158	6.03	6.16	1.61
11-May	12:20 PM	1452	1449	23516	38036	2160	5.69	6.16	1.62
11-May	12:25 PM	1454	1453	23487	38027	2156	5.92	6.16	1.60
11-May	12:30 PM	1460	1452	23494	38094	2162	5.75	6.16	1.61
11-May	12:35 PM	1456	1449	23230	37790	2154	6.09	6.16	1.60
11-May	12:40 PM	1463	1461	23501	38131	2160	5.57	4.99	1.66
11-May	12:45 PM	1453	1466	23347	37877	2153	5.78	4.99	1.66
11-May	12:50 PM	1461	1468	23846	38456	2164	5.51	4.99	1.65
11-May	12:55 PM	1456	1472	23230	37790	2160	5.47	4.99	1.69
11-May	01:00 PM	1462	1473	23362	37982	2165	5.57	4.99	1.67
11-May	01:05 PM	1457	1471	23135	37705	2161	5.69	4.99	1.65
11-May	01:10 PM	1461	1479	23384	37994	2172	5.43	4.99	1.67
11-May	01:15 PM	1462	1474	23245	37865	2165	5.60	4.59	1.68
11-May	01:20 PM	1459	1476	23377	37967	2167	5.44	4.59	1.69
11-May	01:25 PM	1457	1476	23699	38269	2163	5.48	4.59	1.68
11-May	01:30 PM	1457	1470	23340	37910	2165	5.57	4.59	1.68
11-May	01:35 PM	1426	1468	23355	37615	2164	5.45	4.59	1.71
11-May	01:40 PM	1412	1472	23369	37489	2170	5.55	4.59	1.70
11-May	01:45 PM	1369	1455	23076	36766	2161	5.95	4.59	1.70
11-May	01:50 PM	1385	1445	23194	37044	2163	5.82	4.59	1.70
11-May	01:55 PM	1383	1440	22952	36782	2156	5.98	4.59	1.70

** NOTE: THE ACTUAL KILN NATURAL GAS FLOW IS 10 TIMES THE VALUE INDICATED AS REPORTED IN THE
TRIAL BURN REPORT. THE TOTAL NATURAL GAS FLOW INCLUDES THIS FACTOR.

505

DATE	TIME	KILN NAT GAS (SCFH) **	KILN OUT TEMP (F)	SCC NAT GAS (SCCFH)	TOTAL NATURAL GAS FLOW (SCFH)	SCC OUT TEMP (DEG F)	STACK OUT O2 (%)	MASS FEED RATE (TONS/HR)	RETENTION TIME (SEC)
11-May	02:00 PM	1421	1445	23223	37433	2156	5.58	4.59	1.71
11-May	02:05 PM	1431	1442	22864	37174	2152	5.76	4.39	1.70
11-May	02:10 PM	1443	1443	23282	37712	2158	5.69	4.59	1.68
11-May	02:15 PM	1442	1437	22893	37313	2152	5.85	5.12	1.67
11-May	02:20 PM	1477	1443	23157	37927	2156	5.60	5.12	1.67
11-May	02:25 PM	1480	1441	22974	37774	2151	5.78	5.12	1.66
11-May	02:30 PM	1493	1457	23186	38116	2152	5.31	5.12	1.69
11-May	02:35 PM	1489	1451	23025	37915	2149	5.76	5.12	1.66
11-May	02:40 PM	1487	1445	23267	38137	2152	5.57	4.66	1.68
11-May	02:45 PM	1492	1457	23611	38431	2152	5.70	4.66	1.66
11-May	02:50 PM	1484	1452	23142	37982	2157	5.57	4.66	1.68
11-May	02:55 PM	1472	1456	23340	38060	2152	5.63	4.66	1.68
11-May	03:00 PM	1472	1449	23062	37782	2153	5.18	4.66	1.73
11-May	03:05 PM	1474	1454	23010	37750	2152	5.57	4.66	1.70
11-May	03:10 PM	1475	1456	23494	38244	2154	5.60	5.39	1.65
11-May	03:15 PM	1478	1455	23282	38062	2155	5.43	5.39	1.67
11-May	03:20 PM	1466	1455	22842	37502	2153	5.76	5.39	1.66
11-May	03:25 PM	1475	1452	23355	38105	2155	5.50	5.39	1.66
11-May	03:30 PM	1466	1447	23003	37663	2158	5.41	5.39	1.68
11-May	03:35 PM	1478	1450	23362	38142	2150	5.79	5.96	1.62
11-May	03:40 PM	1468	1450	23589	38269	2152	5.73	5.96	1.62
11-May	03:45 PM	1478	1456	23443	38223	2154	5.67	5.96	1.62
11-May	03:50 PM	1472	1448	22952	37672	2152	5.62	5.96	1.65

** NOTE: THE ACTUAL KILN NATURAL GAS FLOW IS 10 TIMES THE VALUE INDICATED AS REPORTED IN THE
TRIAL BURN REPORT. THE TOTAL NATURAL GAS FLOW INCLUDES THIS FACTOR.

TABLE 7-2

NCBC FULL SCALE DEMONSTRATION
TRAIL BURN DATA
RESIDENCE TIME CALCULATION REPORT WORKSHEET
RUN 7B

SAND MOISTURE CONTENT   5.6 PERCENT
TEST START TIME: 08:50 AM
TEST FINISH TIME: 01:35 PM

STATISTICS LISTED CORRESPOND TO THE TEST TIMES LISTED ABOVE

DATE	TIME	KILN NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC NAT GAS (SCFH)	TOTAL NATURAL GAS FLOW (SCFH)	SCC OUT TEMP (DEG F)	STACK OUT O2 (%)	MASS FEED RATE (TONS/HR)	RETENTION TIME (SEC)
AVERAGE VALUE:		1478	1457	23465	38249	2157	5.68	5.31	1.64
MAXIMUM VALUE:		1500	1470	24000	38815	2173	5.99	5.57	1.66
MINIMUM VALUE:		1445	1442	22857	37631	2147	5.04	5.20	1.60
ST.DEV:		14.7	6.4	309.2	360.1	6.1	0.19	0.04	0.02

12-May	08:00 AM	1500	1472	23179	38179	2160	5.36	5.66	1.66
12-May	08:05 AM	1498	1473	23179	38159	2161	5.09	5.12	1.70
12-May	08:10 AM	1500	1477	23252	38252	2162	5.53	6.27	1.62
12-May	08:15 AM	1498	1478	23245	38225	2163	5.20	5.34	1.66
12-May	08:20 AM	1499	1480	23157	38147	2159	5.43	5.53	1.66
12-May	08:25 AM	1500	1487	22967	37967	2154	5.62	5.44	1.66
12-May	08:30 AM	1500	1474	23619	38619	2157	5.47	5.37	1.64
12-May	08:35 AM	1498	1469	23421	38401	2157	5.68	5.38	1.63
12-May	08:40 AM	1500	1473	23772	38772	2165	5.18	5.42	1.66
12-May	08:45 AM	1499	1468	23655	38645	2166	5.21	5.53	1.65
12-May	08:50 AM	1495	1468	23809	38759	2171	5.36	5.37	1.64
12-May	08:55 AM	1496	1470	23494	38454	2164	5.29	5.47	1.66
12-May	09:00 AM	1499	1466	23772	38762	2170	5.04	5.27	1.67
12-May	09:05 AM	1494	1468	23728	38668	2173	5.41	5.47	1.63
12-May	09:10 AM	1497	1463	23729	38698	2172	5.22	5.57	1.65
12-May	09:15 AM	1450	1463	23384	37884	2171	5.31	5.35	1.68
12-May	09:20 AM	1446	1456	23326	37786	2166	5.79	5.31	1.64
12-May	09:25 AM	1453	1455	23260	37790	2159	5.84	5.36	1.64
12-May	09:30 AM	1445	1455	23443	37893	2159	5.76	5.45	1.64
12-May	09:35 AM	1477	1445	23113	37883	2157	5.92	5.30	1.63
12-May	09:40 AM	1472	1449	23091	37811	2157	5.80	5.29	1.65
12-May	09:45 AM	1482	1447	23347	38167	2154	5.60	5.24	1.66
12-May	09:50 AM	1500	1460	22857	37857	2157	5.69	5.25	1.66
12-May	09:55 AM	1500	1456	23289	38289	2154	5.60	5.25	1.65

** NOTE: THE ACTUAL KILN NATURAL GAS FLOW IS 10 TIMES THE VALUE INDICATED AS REPORTED IN THE
          TRIAL BURN REPORT. tHE TOTAL NATURAL GAS FLOW INCLUDES THIS FACTOR.

DATE	TIME	KILN NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC NAT GAS (SCFH)	TOTAL NATURAL GAS FLOW (SCFH)	SCC OUT TEMP (DEG F)	STACK OUT O2 (%)	MASS FEED RATE (TONS/HR)	RETENTION TIME (SEC)
12-May	10:00 AM	1487	1463	22981	37851	2149	5.60	5.22	1.67
12-May	10:05 AM	1486	1457	23347	38207	2158	5.66	5.30	1.64
12-May	10:10 AM	1469	1460	23164	37854	2152	5.75	5.20	1.66
12-May	10:15 AM	1455	1456	23355	37905	2154	5.51	5.24	1.67
12-May	10:20 AM	1459	1465	23186	37776	2156	5.92	5.23	1.64
12-May	10:25 AM	1459	1452	23172	37762	2159	5.74	5.22	1.66
12-May	10:30 AM	1464	1455	23326	37966	2152	5.76	5.26	1.65
12-May	10:35 AM	1454	1449	23091	37631	2155	5.95	5.30	1.64
12-May	10:40 AM	1463	1447	23848	38278	2151	5.88	5.28	1.63
12-May	10:45 AM	1491	1442	23113	38023	2153	5.61	5.33	1.66
12-May	10:50 AM	1500	1456	23428	38428	2158	5.68	5.28	1.63
12-May	10:55 AM	1500	1464	22923	37923	2155	5.66	5.28	1.66
12-May	11:00 AM	1500	1468	23406	38406	2152	5.52	5.27	1.65
12-May	11:05 AM	1500	1467	22930	37930	2152	5.93	5.29	1.63
12-May	11:10 AM	1484	1460	23472	38312	2152	5.73	5.27	1.64
12-May	11:15 AM	1473	1460	23296	38026	2149	5.74	5.27	1.65
12-May	11:20 AM	1465	1455	23238	37888	2152	5.94	5.26	1.64
12-May	11:25 AM	1470	1451	23333	38033	2147	5.99	5.28	1.63
12-May	11:30 AM	1463	1451	23611	38241	2157	5.76	5.33	1.63
12-May	11:35 AM	1366	1453	23736	38396	2157	5.83	5.30	1.62
12-May	11:40 AM	1467	1451	23245	37915	2158	5.76	5.32	1.65
12-May	11:45 AM	1471	1455	23311	38021	2157	5.67	5.30	1.65
12-May	11:50 AM	1466	1453	22989	37649	2152	5.90	5.31	1.65
12-May	11:55 AM	1472	1451	23611	38331	2153	5.71	5.30	1.64
12-May	12:00 PM	1481	1456	23172	37982	2147	5.79	5.32	1.65
12-May	12:05 PM	1485	1454	23956	38806	2155	5.50	5.34	1.64
12-May	12:10 PM	1485	1444	23318	38168	2150	5.57	5.33	1.66
12-May	12:15 PM	1487	1451	23501	39371	2158	5.29	5.33	1.67
12-May	12:20 PM	1486	1455	23487	38347	2153	5.69	5.33	1.64
12-May	12:25 PM	1486	1454	23575	38435	2155	5.63	5.32	1.64
12-May	12:30 PM	1491	1455	23472	38382	2151	5.57	5.33	1.65
12-May	12:35 PM	1481	1453	23450	38250	2152	5.77	5.32	1.64
12-May	12:40 PM	1481	1455	23677	38487	2150	5.60	5.33	1.64
12-May	12:45 PM	1480	1457	24000	38800	2153	5.76	5.33	1.62
12-May	12:50 PM	1487	1454	23941	38811	2157	5.72	5.35	1.62
12-May	12:55 PM	1476	1464	23860	38620	2154	5.82	5.31	1.62
12-May	01:00 PM	1487	1456	23904	38774	2152	5.66	5.29	1.62
12-May	01:05 PM	1482	1456	23663	38483	2157	5.65	5.29	1.64
12-May	01:10 PM	1480	1449	23934	38734	2158	5.75	5.36	1.61
12-May	01:15 PM	1477	1460	23721	38491	2155	5.80	5.36	1.62
12-May	01:20 PM	1479	1458	23970	38760	2162	5.67	5.36	1.62
12-May	01:25 PM	1481	1462	23941	38751	2163	5.76	5.30	1.61
12-May	01:30 PM	1483	1463	23882	38712	2162	5.73	5.33	1.62

** NOTE: THE ACTUAL KILN NATURAL GAS FLOW IS 10 TIMES THE VALUE INDICATED AS REPORTED IN THE
TRIAL BURN REPORT. tHE TOTAL NATURAL GAS FLOW INCLUDES THIS FACTOR.

DATE	TIME	KILN NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC NAT GAS (SCFH)	TOTAL NATURAL GAS FLOW (SCFH)	SCC OUT TEMP (DEG F)	STACK OUT O2 (%)	MASS FEED RATE (TONS/HR)	RETENTION TIME (SEC)
12-May	01:35 PM	1483	1463	23985	38815	2161	5.86	5.33	1.60
12-May	01:40 PM	1478	1463	23985	38765	2160	6.05	5.30	1.59
12-May	01:45 PM	1484	1461	24000	38840	2159	6.12	5.30	1.58
12-May	01:50 PM	1474	1467	23912	38652	2162	6.02	5.29	1.59
12-May	01:55 PM	1484	1456	23963	38803	2160	6.03	5.33	1.59
12-May	02:00 PM	1471	1467	23736	38446	2162	5.94	5.31	1.61
12-May	02:05 PM	1437	1456	23992	38362	2163	6.25	5.30	1.58
12-May	02:10 PM	1427	1447	23655	37925	2161	6.16	5.32	1.61
12-May	02:15 PM	1429	1445	23824	39114	2163	6.16	5.29	1.60
12-May	02:20 PM	1434	1437	23706	38046	2163	6.49	5.33	1.57
12-May	02:25 PM	1478	1445	23824	38604	2160	6.05	5.33	1.59
12-May	02:30 PM	1476	1439	23721	38481	2152	6.15	5.30	1.59

** NOTE: THE ACTUAL KILN NATURAL GAS FLOW IS 10 TIMES THE VALUE INDICATED AS REPORTED IN THE TRIAL BURN REPORT. THE TOTAL NATURAL GAS FLOW INCLUDES THIS FACTOR.

10/19/87   TABLE 7-3

NCBC FULL SCALE DEMONSTRATION
TRIAL BURN DATA
RESIDENCE TIME CALCULATION REPORT WORKSHEET
RUN 7C

SAND MOISTURE CONTENT   5.6 PERCENT
TEST START TIME: 08:10 AM
TEST FINISH TIME: 01:00 PM

STATISTICS LISTED CORRESPOND TO THE TEST TIMES LISTED ABOVE

DATE	TIME	KILN NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC NAT GAS (SCFH)	TOTAL NATURAL GAS FLOW (SCFH)	SCC OUT TEMP (DEG F)	STACK OUT O2 (%)	MASS FEED RATE (TONS/HR)	RETENTION TIME (SEC)
AVERAGE VALUE:		1465	1462	23535	38191	2158	5.62	5.34	1.65
MAXIMUM VALUE:		1500	1477	24000	38780	2172	6.09	5.43	1.70
MINIMUM VALUE:		1368	1448	22989	37219	2150	4.92	5.14	1.61
ST_DEV:		25.5	7.3	196.9	341.3	4.8	0.20	0.06	0.02
16-May	08:00 AM	1476	1459	24000	38760	2169	5.59	5.23	1.63
16-May	08:05 AM	1468	1470	23952	38672	2159	5.28	4.92	1.67
16-May	08:10 AM	1471	1472	24000	38710	2172	4.92	5.22	1.68
16-May	08:15 AM	1473	1472	23970	38700	2169	5.30	5.14	1.66
16-May	08:20 AM	1394	1468	23978	37918	2172	5.15	5.37	1.69
16-May	08:25 AM	1368	1468	23633	37313	2161	5.45	5.33	1.70
16-May	08:30 AM	1468	1479	23450	37530	2158	5.77	5.26	1.66
16-May	08:35 AM	1440	1454	23538	37738	2156	5.44	5.33	1.67
16-May	08:40 AM	1446	1455	23523	37983	2157	5.42	5.17	1.63
16-May	08:45 AM	1473	1459	23479	38209	2154	5.49	5.18	1.67
16-May	08:50 AM	1472	1463	23677	38377	2154	5.42	5.28	1.66
16-May	08:55 AM	1453	1467	23567	38097	2156	5.50	5.29	1.66
16-May	09:00 AM	1462	1467	23728	38378	2163	5.44	5.27	1.65
16-May	09:05 AM	1459	1468	23587	38157	2159	5.44	5.27	1.67
16-May	09:10 AM	1451	1472	23626	38136	2158	5.34	5.33	1.67
16-May	09:15 AM	1447	1470	23523	37993	2158	5.66	5.32	1.65
16-May	09:20 AM	1447	1466	23487	37957	2159	5.47	5.32	1.67
16-May	09:25 AM	1447	1470	23611	38081	2156	5.53	5.29	1.66
16-May	09:30 AM	1437	1466	23208	37578	2153	5.95	5.27	1.65
16-May	09:35 AM	1449	1457	23539	38079	2155	5.57	5.33	1.66
16-May	09:40 AM	1446	1457	23538	37998	2154	5.67	5.35	1.65
16-May	09:45 AM	1452	1452	23479	37999	2157	5.69	5.36	1.65
16-May	09:50 AM	1457	1451	23545	38115	2152	5.90	5.26	1.63
16-May	09:55 AM	1453	1453	23399	37929	2157	5.70	5.36	1.65

** NOTE: THE ACTUAL KILN NATURAL GAS FLOW IS 10 TIMES THE VALUE INDICATED AS REPORTED IN THE
          TRIAL BURN REPORT. THE TOTAL NATURAL GAS FLOW INCLUDES THIS FACTOR.

DATE	TIME	KILN NAT GAS FEED RATE (SCFH)	KILN NAT GAS FEED TEMP (F)	SCC NAT GAS FLOW (SCFH)	TOTAL NATURAL GAS FLOW (SCFH)	SCC OUT TEMP (DEG F)	STACK OUT SO2 (%)	MASS RETENTION FEED RATE (TONS/HR)	MASS RETENTION (SEC)
						2153	5.95	5.27	1.64
16-May	10:00 AM	1451	1447	23604	38174	2156	5.77	5.34	1.64
16-May	10:05 AM	1451	1447	23333	37857	2155	5.74	5.34	1.64
16-May	10:10 AM	1455	1459	23611	38221	2155	5.70	5.34	1.64
16-May	10:15 AM	1460	1464	23428	38028	2159	5.63	5.34	1.64
16-May	10:20 AM	1454	1458	23428	37961	2162	5.62	5.34	1.64
16-May	10:25 AM	1457	1457	23589	38258	2163	5.50	5.34	1.65
16-May	10:30 AM	1467	1454	23457	38127	2163	5.50	5.34	1.65
16-May	10:35 AM	1473	1448	23421	38151	2156	5.63	5.32	1.63
16-May	10:40 AM	1475	1452	23501	38251	2156	5.76	5.30	1.64
16-May	10:45 AM	1500	1457	23575	38575	2151	5.63	5.37	1.63
16-May	10:50 AM	1497	1456	23553	38523	2157	5.80	5.38	1.62
16-May	10:55 AM	1470	1466	23326	38026	2159	5.60	5.34	1.64
16-May	11:00 AM	1492	1471	23633	38453	2151	5.79	5.37	1.64
16-May	11:05 AM	1473	1467	23326	38056	2163	5.75	5.29	1.62
16-May	11:10 AM	1472	1467	23304	38024	2155	5.73	5.38	1.64
16-May	11:15 AM	1470	1463	23479	38179	2152	6.00	5.37	1.64
16-May	11:20 AM	1480	1452	23274	38074	2152	6.09	5.32	1.62
16-May	11:25 AM	1500	1469	23780	38780	2161	5.54	5.38	1.61
16-May	11:30 AM	1500	1475	23728	38728	2159	5.62	5.40	1.63
16-May	11:35 AM	1497	1464	23560	38530	2163	5.57	5.43	1.62
16-May	11:40 AM	1497	1465	23797	38757	2160	5.58	5.37	1.63
16-May	11:45 AM	1492	1477	23340	38260	2163	5.96	5.37	1.63
16-May	11:50 AM	1487	1459	23750	38620	2163	5.58	5.38	1.62
16-May	11:55 AM	1497	1466	23604	38474	2165	5.66	5.37	1.63
16-May	12:00 PM	1484	1466	23677	38517	2166	5.78	5.40	1.63
16-May	12:05 PM	1487	1465	23853	38723	2161	5.67	5.38	1.61
16-May	12:10 PM	1482	1463	23604	38424	2164	5.47	5.37	1.62
16-May	12:15 PM	1492	1471	23699	38619	2165	5.45	5.38	1.65
16-May	12:20 PM	1423	1454	22989	37219	2153	5.74	5.41	1.64
16-May	12:25 PM	1449	1464	23394	37874	2152	5.64	5.39	1.68
16-May	12:30 PM	1461	1457	23010	37620	2150	5.96	5.39	1.66
16-May	12:35 PM	1450	1459	23301	38301	2161	5.52	5.34	1.64
16-May	12:40 PM	1468	1467	23457	38337	2156	5.57	5.40	1.65
16-May	12:45 PM	1481	1461	23260	38070	2158	5.81	5.38	1.65
16-May	12:50 PM	1489	1456	23589	38479	2160	5.68	5.40	1.63
16-May	12:55 PM	1483	1462	23429	38258	2156	5.53	5.36	1.63
16-May	01:00 PM	1494	1465	23604	38544	2158	5.76	5.36	1.65
16-May	01:05 PM	1497	1461	23296	38166	2158	5.76	5.39	1.62
16-May	01:10 PM	1489	1463	23633	38523	2156	5.95	5.36	1.62
16-May	01:15 PM	1488	1468	23367	38447	2160	5.67	5.33	1.63
16-May	01:20 PM	1489	1461	23443	38333	2155	5.81	5.33	1.62
16-May	01:25 PM	1489	1464	23633	38523	2152	5.70	5.39	1.64
						2155	5.73	5.35	1.63

** NOTE: THE ACTUAL KILN NATURAL GAS FLOW IS 10 TIMES THE VALUE INDICATED AS REPORTED IN THE
TRIAL BURN REPORT. THE TOTAL NATURAL GAS FLOW INCLUDES THIS FACTOR.

RUN 7C   5/16/87

DATE	TIME	KILN NAT GAS (SCFH)	KILN OUT TEMP (F)	SCC NAT GAS (SCFH)	TOTAL NATURAL GAS FLOW (SCFH)	SCC OUT TEMP (DEG F)	STACK OUT O2 (%)	MASS FEED RATE (TONS/HR)	RETENTION TIME (SEC)
16-May	01:30 PM	1482	1464	23201	38021	2153	5.85	5.37	1.64
16-May	01:35 PM	1487	1452	23619	38489	2158	6.02	5.37	1.60
16-May	01:40 PM	1490	1455	23589	38489	2149	5.98	5.40	1.61
16-May	01:45 PM	1484	1455	23465	38305	2157	5.92	5.38	1.62
16-May	01:50 PM	1491	1457	23567	38477	2152	5.98	5.39	1.61
16-May	01:55 PM	1481	1455	23377	38187	2153	5.86	5.37	1.63
16-May	02:00 PM	1497	1453	23633	38603	2157	5.99	5.36	1.60

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SCC RESIDENCE TIME

RUN 7A   MAY 12, 1987
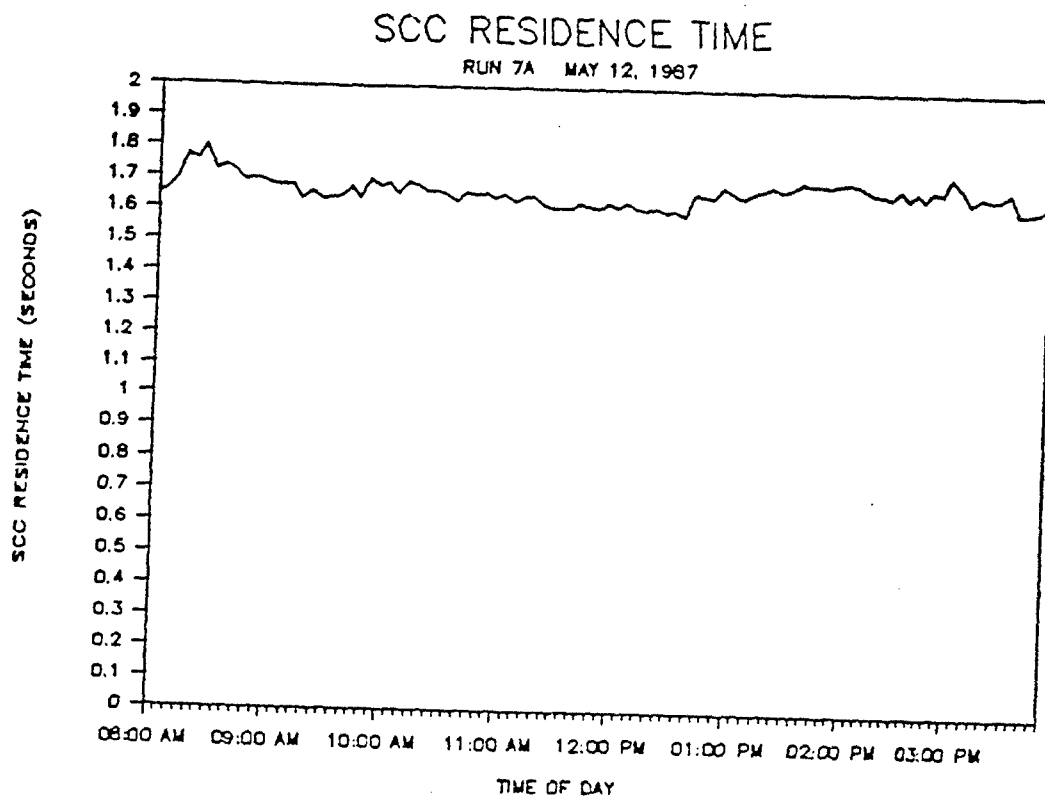
FIGURE   7-1

RESIDENCE TIME

MAY 12, 1987   RUN 78
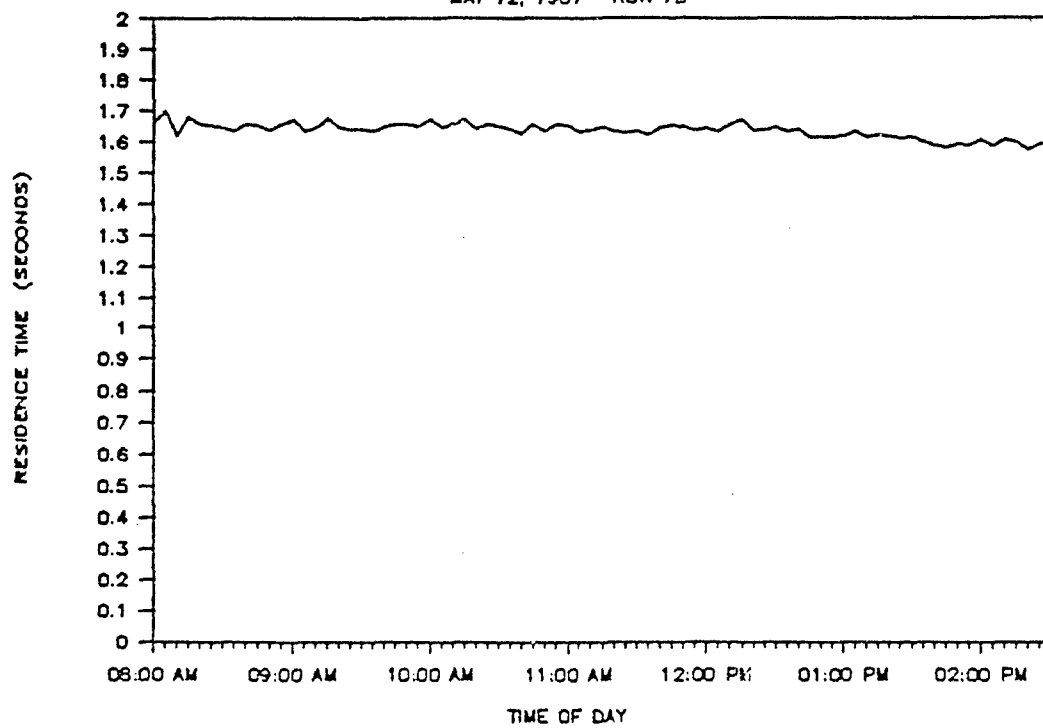
FIGURE 7-2

SCC RESIDENCE TIME

MAY 16, 1987   RUN 7C
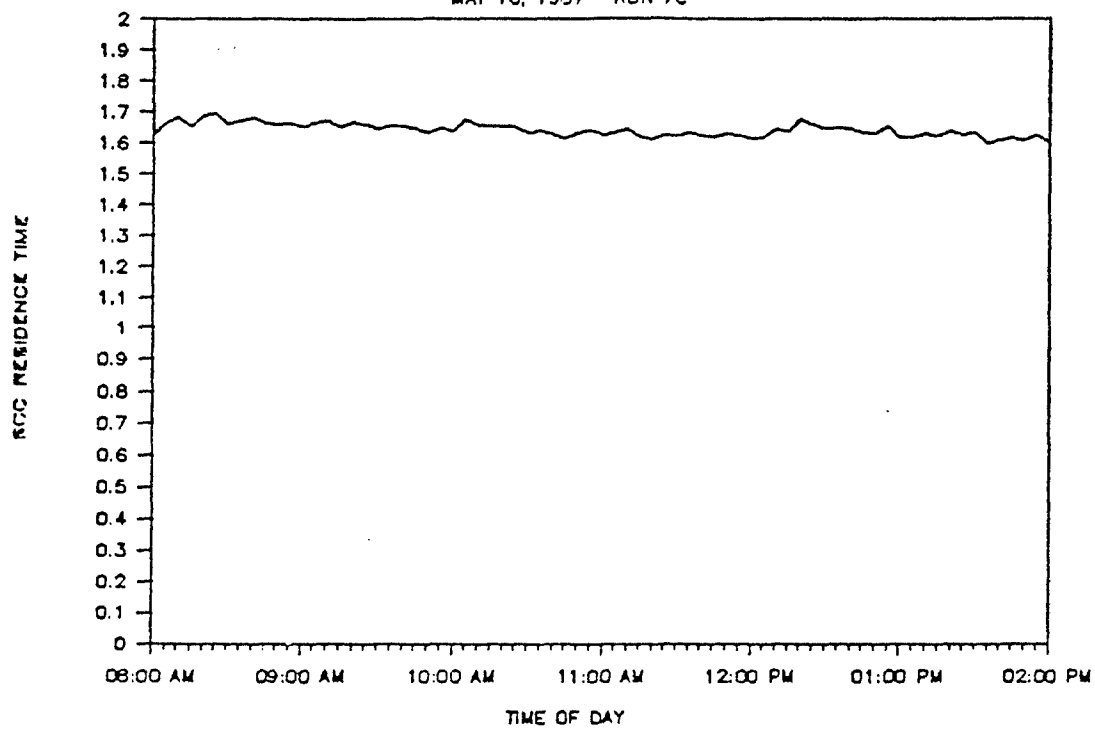
FIGURE   7-3

ATTACHMENT 1

THERMAL RELIEF VALVE
TEMPERATURE SAG DATA
FOR AUGUST 31, 1987

TEMPERATURE SAG CURVE

MWP2000

NCBC, GULFPORT, MISSISSIPPI

(FOLLOWING STAGED EMERGENCY SHUTDOWN)

TIME T+ MIN.	KILN TEMP DEG. F	SCC TEMP DEG F
0	1475	2156
3	894	1718
6	1036	1677
9	1048	1612
12	1039	1564
15	1027	. . . . .
18	1048	1530
21	1061	1493
24	1064	1465

NOTE*** This was an emergency shutdown staged to derive a
temperature decay rate for the secondary combustor and rotary
kiln. At time=0 both burners were shutdown and the diverter "T"
opened. Opening the diverter "T" ocurred at T plus 3 minutes.
The feed rate at time of shutdown was 5.3 tons per hour. It took
approximately 20 minutes to empty 80 percent of the soil from
the kiln. It is impossible to get all the soil from the kiln
because of the presence of refractory dams.

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SECONDARY COMBUSTOR

KILN

MWP-2000
TEMPERATURE SAG DATA
FROM AUGUST 31, 1987
STAGED EMERGENCY SHUTDOWN

TIME (MINUTES AFTER BURNER SHUTDOWN)

EXIT GAS TEMPERATURE (DEGREES F)

461510

K·E IN X 10 TO THE CENTIMETER 18 X 25 CM
KEUFFEL & ESSER CO MADE IN USA
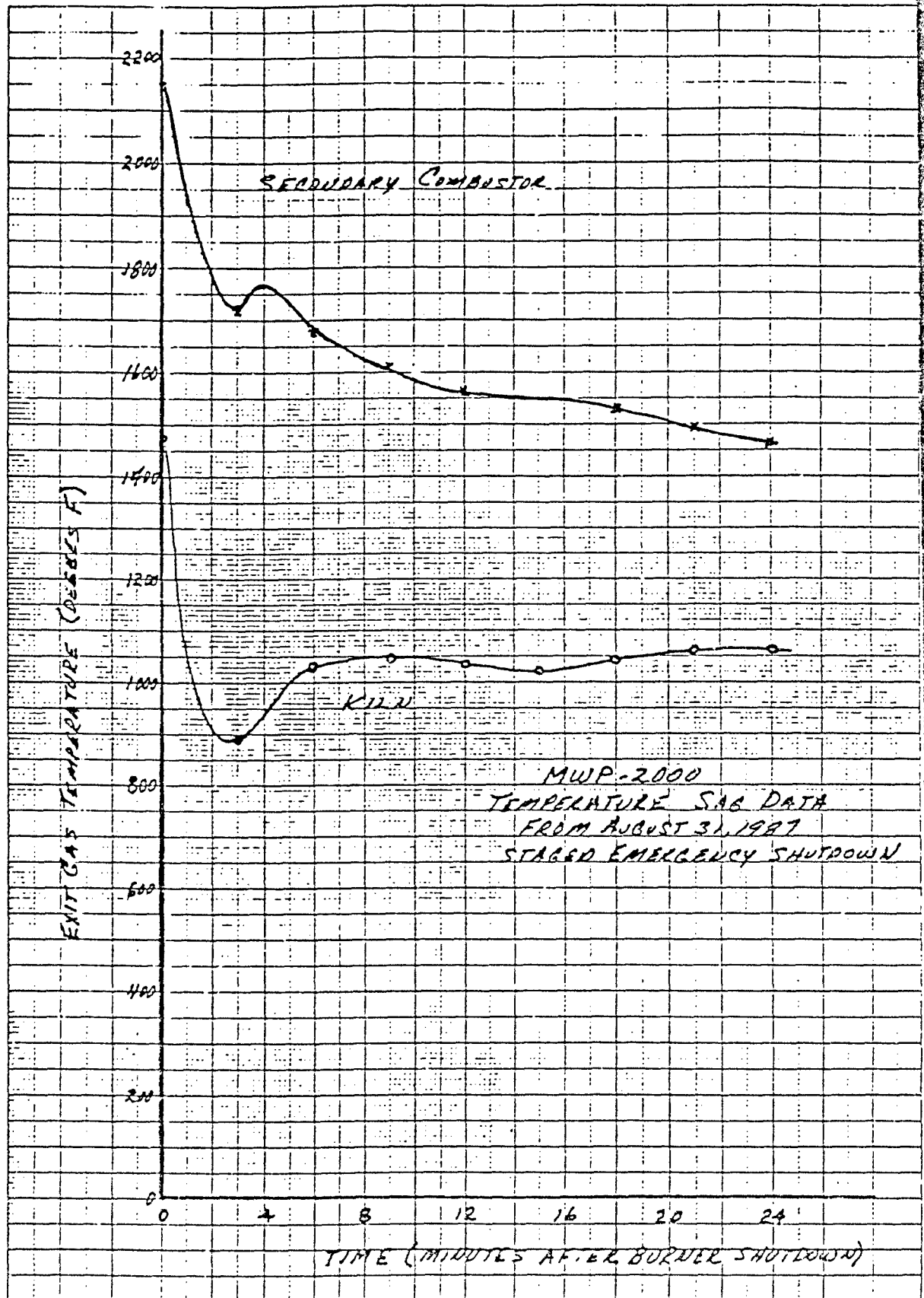
Secondary Combustion Outlet Temp
8/31/87

Flame-out
12:17 pm

600   1200   1800   2400   3:—

Time

Relative Bed
Kiln Outlet
Temp
0-3000 °F.
Flameout
12:17 pm

8/31/87

600   1200   1800   2400   3000

Time

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ATTACHMENT 2

DERIVATION OF AN EQUATION FOR AN INDICATOR
OF COMBUSTION GAS RESIDENCE TIME
FOR THE MWP-2000 MOBILE INCINERATOR
AT NCBC, GULFPORT, MS

DERIVATION OF RESIDENCE TIME
EQUATION FOR THE MWP-2000 INCINERATOR

The MWP-2000 incinerator at NCBC gains nearly all of its heat input from natural gas. This simplifies the calculations which determine the quantity of combustion gas formed and hence the residence time of gases in the secondary combustion chamber.

Overview

There are four gases that flow through the secondary combustor: oxygen, nitrogen, carbon dioxide, and water vapor. The carbon dioxide and some of the water are formed in the combustion processes nitrogen naturally occurs in the combustion air flowing into the system.

The stoichiometric combustion of natural gas is controlled by the following equation:

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O \tag{1}$$

This equation is the basis in the following sections for calculation of gas volumes and the derivation of a residence time equation.

Carbon Dioxide

Equation 1 shows that for every mol of natural gas consumed in the combustion process, one mol of carbon dioxide is formed. Because a mol of any ideal gas occupies the same volume as any other ideal gas, namely 379 ft^3/mol at 60°F, and 14.7 psia, the volume of carbon dioxide produced in the combustion process is equivalent to the volume of methane consumed.

$$\text{Volume of } CO_2 = \text{Volume of } CH_4 \tag{2}$$

As described in Attachment 3, the contribution of other organics is negligible.

Nitrogen

The nitrogen enters the system with the combustion air and is not involved in any reactions. Therefore, to calculate the the nitrogen gases present, one must first calculate the total air entering the system. This is done by first determining the quantity of nitrogen flowing through the system that is proportional to the stoichiometric quantity of oxygen.

Step 1. Convert the natural gas flow through the system from SCFH to lbs/hr.

$$CH_4 = \left[CH_4 \; ft^3/hr \right] \left[1 \; MOL \; CH_4 / 379 \; ft^3 \right] \left[16 \; lb \; CH_4 / MOL \; CH_4 \right] \tag{3}$$

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$$CH_4 \; lb/hr = CH_4 \; SCFH \cdot (16/379) \qquad (4)$$

Step 2 Convert pounds of CH_4 to cubic feet of nitrogen

$$N_2 = \left(CH_4 \frac{lb}{hr}\right) \cdot \left(\frac{1\,mol\,CH_4}{16\,lb\,CH_4}\right) \cdot \left(\frac{2\,mol\,O_2}{1\,mol\,CH_4}\right) \cdot \left(\frac{1\,mol\,Air}{.21\,mol\,O_2}\right) \cdot \left(\frac{79\,mol\,N_2}{1\,mol\,Air}\right) \left(\frac{379\,ft^3}{1\,mol\,N_2}\right) \qquad (5)$$

$$N_2 \; SCFH = \left(CH_4 \; lb/hr\right) \cdot (178.220) \qquad (6)$$

Step 3 Convert stoichiometric nitrogen to actual, total nitrogen.

Equation 6 calculates the volumetric flow rate of nitrogen at stoichiometric conditions. To obtain the actual volumetric flow rate of nitrogen, the stoichiometric flow rate must be multiplied by a correction factor derived from the excess oxygen measured at the stack.

This correction factor is derived by assuming that the total air flow into the system contains 21% Oxygen. The ratio of total oxygen into the system to the stoichiometric quantity of oxygen needed is:

$$\frac{\text{% Total Oxygen}}{\text{% Stoichiometric Oxygen}}$$

The stoichiometric oxygen is given by:

(% Total oxygen in air fed to system) - (% Excess oxygen)

or stated otherwise:

$(21 - O_2\% \text{ ......})$

where the excess oxygen is measured in the stack

The correction factor therefore becomes:

$$\text{Stoich. to actual} = \frac{21}{21 - \text{stack } O_2\%} \qquad (7)$$

Because nitrogen is neither created nor destroyed in this combustion process and because the ratio of oxygen to nitrogen is constant, the ratio of total oxygen to stoichiometric oxygen is the same as the ratio of total nitrogen to stoichiometric nitrogen.

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Step 4   Substitution

By combining equations 4, 6, and 7 the following equation results:

$$N_2 \ SCFH = \frac{(CH_4 \ SCFH) \quad 158.0}{(21 - STACK \ O_2 \%)} \qquad (8)$$

Oxygen

The stoichiometric amount of oxygen is consumed in the production of carbon dioxide. As shown in equation 1, two mols of oxygen are required for each mol of methane. Therefore, the stoichiometric quantity of oxygen is known by the measurement of methane consumed. However, excess air enters the system and the oxygen associated with the excess air must be accounted.

The amount of excess air in the system can be determined from the known amount of stoichiometric oxygen by multiplying by the following correction ratio:

$$(O_2\% \ _{excess}) \ / \ (O_2\%_{stoich})$$

Therefore by combining equation 1 with this ratio:

$$O_2 \ _{stoich}SCFH = 2 \ (CH_4 \ SCFH) \ x \ \frac{O_2\%_{excess}}{O_2\% \ _{stoich}} \qquad (9)$$

The stoichiometric fraction of oxygen is equal to:

$$O_2\% \ _{total \ air} - O_2\% \ _{excess}$$

or otherwise stated as:

$$(21 - O_2\%_{excess})$$

by combining with equation 9 one obtains:

$$O_2 \ _{excess}SCFH = 2 \ (CH_4 \ SCFH) \ x \ \frac{O_2\%_{excess}}{(21 - O_2\% \ _{excess})} \qquad (10)$$

where the $O_2\%_{excess}$ is measured directly at the stack.

Water

The water flowing through the SCC comes from three possible sources:
solids feed moisture, water formed from combustion, and steam generated
from the ash quench.

The following equations use a specific volume of steam at saturated
conditions as 26.799 ft³/lb for 212°F and 14.69 psia. Although the
steam is actually superheated, the change in density of steam is corrected
by a temperature correction factor, described later, which is applied to
all of the gases.

Solids Feed Moisture:

The water vapor entering the secondary combustor as a result of the
moisture in the soil is given by:

$$H_2O(ft^3/hr) = (Solids\ feed\ lbs/hr)(moisture\ content)(26.799\ ft^3/lb)$$

(11)

Water of combustion:

As shown in equation 1, two mols of water are produced for every mol of
methane consumed, therefore,

$$(H_2O)_{combustion} = (CH_4\ SCFH) \times 2$$ (12)

Ash quench water:

The hot ash falling into the ash quench produces substantial quantities of
steam which subsequently flow into the secondary combustor. A heat and
mass balance was performed on the ash quench system. Those calculations
show that for every pound of ash produced, 0.232 pounds of steam are
produced when the kiln outlet temperature is 1450°F.

Therefore, the quantity of steam produced in the ash quench is given by:

$$(H_2O)_{qnch} = (soil\ feed\ lbs/hr)(.232\ lb\ steam/lb\ soil)(26.799\ ft^3/lb$$

(13)

The derivation of equation 13 is presented as Attachment 4.

The heat and mass balance calculations also show that the final residence
time is negligibly affected by large variations in the ash exit
temperature. Therefore, as explained in Attachment 4, the ash exit
temperature was omitted from the final residence time equation.

Final Residence Time Derivation

The residence time through the secondary combustor is fundamentally given by:

$$RT(sec) = (SCC \text{ volume } ft^3)/(SCC \text{ Volumetric flow rate } ft^3/sec) \qquad (14)$$

By expanding this equation to further define the terms, one can derive the following equation:

$$RT = \frac{(1378.9 \; ft^3 \; SCC \; VOLUME)(3600 \; SEC/HR)}{\underbrace{\left[\frac{T_{scc}+460}{520}\right]}_{A}\underbrace{\left[CO_2+N_2+O_2+\left(H_2O\right)_c\right]}_{B}+\underbrace{\left[\frac{T_{scc}+460}{672}\right]}_{C}\underbrace{\left[\left(H_2O\right)_{Feed}+\left(H_2O\right)_{Quench}\right]}_{D}} \qquad (15)$$

Terms A and B in equation 15 represent the volumetric flow rate as a result of the products of combustion. Because equations 2, 8, 10, and 12, had assumed standard conditions, i.e., 60°F, a temperature correction must be made to account for the decreased density of gas at higher temperatures; hence term A was included. That term is the ratio of the secondary temperature to standard temperature in terms of degrees Rankin.

Terms C and D in equation 15 represent the volumetric flow rate of added water to the system. Term D represents the water contribution from the feedstock soil and the water added from the ash quench. Term C is an ideal gas temperature correction factor. That term is the ratio of the secondary temperature to a base temperature of 672°R (212°F). A base temperature of 212°F was used because non standard conditions were previously assumed.

By combining equation 15 with equations 2, 8, 10, 11, 12, and 13 equation 16 results as the final residence time equation.

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EQUATION 16

$$RT = \frac{(1378.9 \ Ft3)(3600 \ SEC/HR)}{\left(\frac{T_{scc}+460}{520}\right)\left[CH_4 + \left(\frac{CH_4 \cdot O_2 \cdot 2}{(21-O_2)\cdot}\right) + \left(\frac{CH_4 \cdot 158.0}{21-O_2}\right)\right] + \left(\frac{T_{scc}+460}{672}\right)\left[\left(\frac{S \cdot M \cdot 26.799}{100}\right) + \left(S \cdot .232 \cdot 26.799\right)\right]}$$

WHERE:

S = SOLIDS FEED RATE, lbs/hr

M = SOIL MOISTURE CONTENT, PERCENT

T_{scc} = SECONDARY COMBUSTOR TEMP, °F

CH_4 = NATURAL GAS FLOW RATE IN BOTH THE KILN AND THE SCC, (SCFH)

O_2 = OXYGEN CONTENT OF STACK GAS, PERCENT

1378.9 = INTERNAL VOLUME OF SCC

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ATTACHMENT 3

CONTRIBUTION OF HIGH CONCENTRATIONS OF
HERBICIDES TO THE COMBUSTION GAS
RESIDENCE TIME IN THE
SECONDARY COMBUSTION CHAMBER

EG&G Idaho, Inc.

FORM EG&G-2631 (Rev 4-78)

ENGINEERING DESIGN FILE

PROJECT/TASK _NCBC TRIAL BURN REPORT_   DATE _Oct 14 1987_

SUBTASK _THIRD EPA RESPONSE_   EDF PAGE NO. _1_ OF _7_

SUBJECT

Contribution of Herbicides to Combustion Gas

ABSTRACT

The contribution of Herbicides to the combustion gas and the Resulting residence time is discussed.

It was determined that no significant effect to the residence time would Result from the inclusion of herbicides.

DISTRIBUTION (COMPLETE PACKAGE):

DISTRIBUTION (COVER SHEET ONLY): PROJECT EDF FILE LOG, EDF SERIAL NO. LOG

AUTHOR	DEPT.	REVIEWED	DATE	APPROVED	DATE
D.J. Haley	HWP				

2, 4, D

$$
\begin{array}{c}
COOH \\
| \\
H - C - H \\
| \\
O
\end{array}
$$

$C_8 Cl_2 H_7 O_3$

$MW = 221.04 \ g/g\text{-}mol$
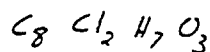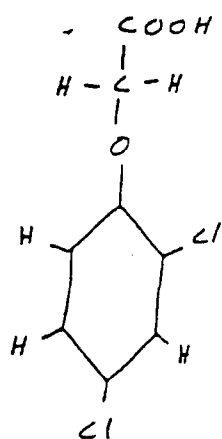
$$C_8 Cl_2 H_6 O_3 + 7.5 O_2 \longrightarrow 8 CO_2 + 2.0 H_2O + 2 HCl$$
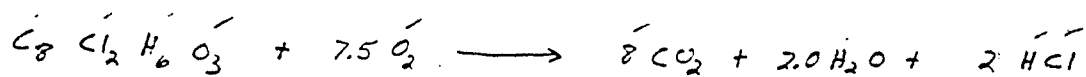
From the HO site characterization report the maximum observed 24-D concentration was 20,800,000 ppb or 2.08% by weight

The worst case 24-D incineration rate would be

$$5.3 \ \frac{tons \ soil}{hR} \cdot \frac{2000 \ lb}{ton} \cdot \frac{1 hr}{60 min} \cdot \frac{2.08 \ lb \ 24D}{100 \ lb \ soil} \cdot \frac{454 \ g}{lb} \cdot \frac{1 \ g\text{-}mol}{221 \ grams}$$

$$= \underline{7.54} \ g\text{-}mols \ 24D$$
burned
per minute
maximum

For every mole of 24D burned
12 moles of gas are produced.

Therefore :

$$7.54 \ \frac{\text{moles 24D burned}}{\text{min}} \cdot \frac{12.0 \ \text{moles gas}}{\text{mole 24D}} = 90.48 \ \frac{\text{g-mols}}{\text{min}} \ \text{gas}$$

From the ideal gas law

$$P V = n \bar{R} T$$

$$\left(14.7 \ \frac{lb_f}{in^2}\right) \cdot \left(\frac{144 \ in^2}{ft^2}\right) \cdot \left(V \ \frac{ft^3}{min}\right) = \left(90.48 \ \frac{\text{g-mols}}{min}\right)\left(\frac{1 \ lb \cdot mol}{454 \ g \cdot mol}\right) \cdot$$

$$\left(1545 \ \frac{ft \cdot lb_f}{lb \cdot mol \cdot °R}\right) \cdot \left(2560 °R\right)$$

$$V = 372.37 \ ft^3/min$$

$$= 6.206 \ ft^3/sec \qquad \text{gas produced from}$$
$$\text{2.4 -D Incineration}$$

2,4,5 - T   [2 4 5 Trichluro phrno xy Acetic Acid]

$MW = 255.49$ g/g·mole

$C_8 H_5 Cl_3 O_3$
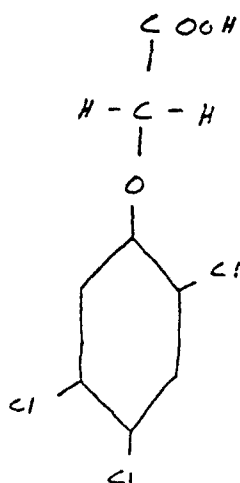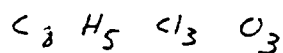
Max concentration in soil = 2.77%

$$5.3 \frac{tons\ soil}{hR} \cdot \frac{2000\ lb}{ton} \cdot \frac{lhe}{comin} \cdot \frac{2.77\ lb\ 245T}{100\ lb\ soil} \cdot \frac{454\ g}{lb} \cdot \frac{1\ g\text{-}mol}{255.5\ g} =$$

$$8.7 \frac{g\text{-}mol}{min}\ 2,4,5\ T\ burned$$

$$C_8 H_5 Cl_3 O_3 + 7\ O_2 \longrightarrow 8\ CO_2 + 4\ H_2O + 3\ HCl$$
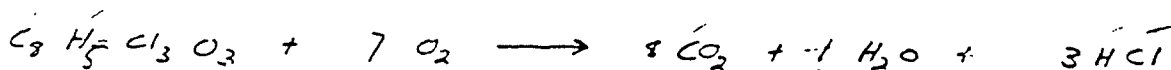
1 mole of 245T produces 12 mols off gas

Therefore:

$$8.7 \frac{g\text{-}mols\ 245T}{min} \cdot \frac{12\ mols\ gas}{1\ mole\ 245T} = 104.4\ mols\ gas/min$$

produced.

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From ideal gas law

$$PV = n\bar{R}T$$

$$\left(14.7 \frac{lb_f}{in^2}\right) \cdot \left(\frac{144 \, in^2}{ft^2}\right) \cdot \left(V \frac{ft^3}{min}\right) = \left(1044 \frac{g\text{-}mols}{min}\right) \cdot \left(\frac{1 \, lb\text{-}mol}{454 \, g\text{-}mole}\right) \cdot$$

$$\left(1545 \frac{ft\text{-}lb_f}{lb\text{-}mol \cdot °R}\right)\left(2560 °R\right)$$

$$V = 429.6 \, ft^3/min$$
$$= 7.16 \, ft^3/sec \quad \text{of gas produced.}$$

The Residence time is fundamentally

given by:

$$\theta = \frac{V}{Q}$$

where $\theta =$ Residence time, sec

$V =$ Volume of scc, 1378.9 ft^3

$Q =$ Volumetric flow Rate through scc, ft^3/sec

The "typical" Residence time
observed was approximately 1.6 seconds
assuming no contribution from the
herbicides.

Therefore the volumetric flow Rate
was:

$$Q = \frac{V}{\theta} = \frac{1378.9}{1.6} = 861.81 \; ft^3/sec$$

if the contribution of herbicides is
included:

$$\theta' = \frac{V}{Q + Q_h}$$

where Q_h = 6.2 + 7.16 = 13.4 ft^3/sec
= contribution of herbicides

Therefore:

$$\theta' = \frac{1378.9}{861.8 + 13.4} = 1.575 \; sec$$

The addition of herbicides to the Residence
time equation reduces the Residence time by only 1.5%

This is a worst case assumption.
Normally the herbicide concentration
will be orders of magnitude lower.

Therefore, the herbicide contribution
is considered negligible.

ATTACHMENT 4

ASH QUENCH SYSTEM HEAT AND MASS BALANCE

ASH QUENCH BALANCE
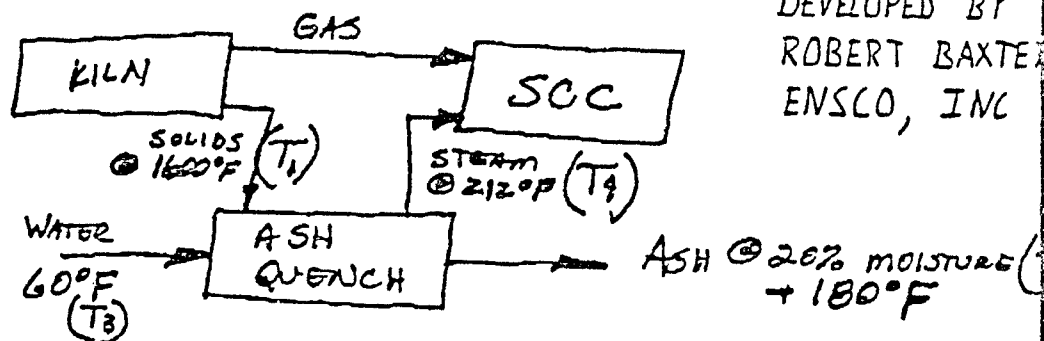
EQUATIONS:

HEAT LOSS by SOLIDS

$$Q_1 = \dot{m}_{ASH} \, C_{P_3} \left(T_1 - T_2 \right)$$

$$C_{P_3} \text{ of SOLIDS} = 0.2 \, Btu/\# \, °F$$

HEAT GAIN by WATER

SENSIBLE HEAT/# of WATER LEAVING WITH ASH.

$$Q_2 = \dot{m}_{ASH} \left(\text{moisture} \right) C_{P_W} \left(T_2 - T_3 \right)$$

SENSIBLE HEAT/# OF STEAM GENERATION

$$Q_3 = \left[\dot{m}_{STM} - \dot{m}_{ASH} \left(\text{moisture} \right) \right] C_{P_W} \left(T_4 - T_3 \right)$$

LATENT HEAT/# OF STEAM GENERATION

$$Q_4 = \lambda_V \, \dot{m}_{STM}$$

$$C_{P_W} = 1 \, Btu/\# \, °F$$

$$\lambda_V = 970.3 \, Btu/\#$$

$$Q_1 = Q_2 + Q_3 + Q_4$$

$$\dot{m}_{ASH}\, C_S (T_1 - T_2) = \dot{m}_{ASH(moist)}\, C_{P_W}(T_2 - T_3) + \left[\dot{m}_{STM} - \dot{m}_{ASH(moist)}\right] C_{P_W}(T_4 - T_3) + \lambda_V\, \dot{m}_S$$

ASSUMPTION: $T_4 = 212\,°F$

$T_3 = 60\,°F$

$T_2 = 180\,°F$

MOISTURE $= 20\%$

THE EQUATION BECOMES:

$$\dot{m}_{ASH}(.2)(T_1 - 180) = \dot{m}_{ASH}(.2)(1)(180 - 60) + \left[\dot{m}_{STM} - \dot{m}_{ASH}(.2)\right](1)(212 - 60) + 970.3\,\dot{m}_{AS}$$

AFTER PLUGGING IN THE CONSTANTS &
THE ASSUMPTIONS FROM ABOVE, THE
EQUATION REDUCES TO:

$$\dot{m}_{STM} = \frac{\dot{m}_{ASH}(.2)\,T_1 - 29.6\,\dot{m}_{ASH}}{1122.3}$$

THEREFORE, 1 lb OF ASH GENERATES THE FOLLOWING
STEAM FOR THE ASSOCIATED TEMPERATURE.

ASH SOLIDS TEMP (DEG. F)	ASH QUENCH STEAM (lbs)
1200	0.1875
1300	0.2053
1400	0.2231
1500	0.2409
1600	0.2587

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BASED ON THE STEAM GENERATION FROM THE
QUENCH HEAT + MASS BALANCE, AND USING
THESE NUMBERS FOR RESIDENCE TIME CALCULATION
A 200°F VARIATION IN THE SOLIDS TEMPERATURE

VARIES THE RESIDENCE TIME BY 0.021 SECONDS.

THEREFORE A SOLIDS TEMP. of 1450°F WAS
ASSUMED (0.232 # STEAM)/# ASH). THIS
IS APPROXIMATELY THE AVERAGE   EXIT TEMP.
FROM THE TRIAL BURNS AND   IS THE   BEST
NUMBER FOR NORMAL OPERATION.

APPENDIX H

ALTERNATE ASH DISPOSITION PLAN AND WITHDRAWAL

Appendix H contains the EG&G Idaho letters to EPA that proposed and subsequently withdrew the alternate ash handling plan that was submitted to EPA. This appendix was reproduced from the best available copy. Only attachments 4 and 6 are provided with this appendix; the other attachments would not significantly enhance the reader's understanding of the trial burn reporting process.

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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INEL

Idaho National Engineering Laboratory

November 20, 1987

Ms. Carone Falconer
EPA Region IV
345 Cortland St NE
Atlanta, GA   30365

WITHDRAWAL OF ALTERNATE ASH STORAGE PLAN AND CLARIFICATION OF OTHER
MISCELLANEOUS TECHNICAL ISSUES - DJH-23-87

Dear Ms. Falconer:

Although the Air Force and EG&G Idaho unanimously agree that the ash
disposition plan presented to you on November 10 is technically sound
and protective of the environment, we feel that the costs for
procurement and delivery of additional roll off boxes will be quickly
offset by the delays caused by additional EPA questions. Therefore,
we wish to withdraw our request to use the plastic lined storage bays
and return to the previous permitted plan of using roll off boxes for
process ash holding.

Per our discussion on November 19, it is my understanding that no
additional questions will arise concerning the use of roll off
boxes. Therefore, we have taken immediate action to procure the
boxes necessary for operation.

Those boxes will be used to store process ash from the incinerator
pending analytical results. A maximum of 57 boxes will be used.
Those boxes will hold approximately 15 cubic yards of process soil
and will be covered to prevent rainwater intrusion.

This letter also addresses several other issues that we discussed
yesterday. I hope that this information helps you in your permit
writing process.

Soil Moisture Measurement:

    As discussed in my letter of November 10, (DJH-21-87) we intend
    to use the infrared moisture analyzer as much as possible. The
    range for that instrument will be 0 to 20% moisture. The data
    from that instrument will be fed directly into the DAS for use in

EG&G Idaho, Inc.   *F.O. Box 1625   Idaho Falls, ID 83415*

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the residence time equation. If the infrared device fails, then
we would use a manual method of soil moisture determination.
That method would strictly employ ASTM Method D2216-80. A copy
of that method is provided as Attachment 1 for reference. The
data from that analysis would be entered into the DAS via an
operator controlled keyboard entry. In either case, the moisture
content used by the DAS will be printed on the 15 minute data
logs.

Sand Moisture Content for RCRA Trial Burn:

The moisture content of the sand processed during the RCRA trial
burn was 5.6%. That value was previously reported in my letter
of October 19 (DJH-18-87) and was used in the residence time
calculation presented therein. A copy of the laboratory moisture
analysis report is provided as Attachment 2.

Residence Time Calculation Algebraic Verification:

Attachment 3 is an EG&G Engineering Design File that shows the
residence time equation algebraic manipulation using actual data
values observed during Run 7A of the RCRA trial burn. That
calculation demonstrates that the data presented in my letter of
October 18 correspond to the stated residence time.

Analytical Methodology for Comprehensive Analysis:

Per our discussions, it is our understanding that we will be
required to perform a comprehensive analysis on the processed
soil and split samples with EPA. Those samples would be taken
one week after startup of routine operations and on a monthly
basis thereafter. Attachment 4-A lists the constituents for
which we intend to analyze and the proposed analytical
methodology. That list of constituents includes all of the
constituents requested by Mr. Myles Morris on September 11,
1986. A copy of his letter was transmitted to you on November 10
(DJH-20-87).

Attachment 4-A omits specification of the methodology for certain
constituents. The methodology for the constituents not specified
in Attachment 4-A is provided in Attachment 4-B, which was
provided to us by IT Analytical Services.

"s. Carone Falconer
November 20, 1987
DJH-23-87
Page 3

Detection Limit for Total Tetra Dioxins and Furans:

    The analytical method for total tetra chlorinated benzo dioxins
    (total tetra CDD) and total tetra chlorinated dibenzo furans
    (total tetra CDF) will be EPA Method SW846-8280. That method
    calls for a detection limit of 2.0 ppb. Discussions with our
    analytical laboratories, however, have indicated that detection
    limits in the 1.0 ppb range will be routinely available because
    the sample matrix will be relatively free of interfering
    compounds. The method for 2,3,7,8 TCDD (isomer specific) will
    also be EPA method SW-846-8280 but will have a detection limit of
    approximately 0.1 ppb.

Revision to Ambient Air Monitoring Plan:

    Attachment 5 is a revised page to the Ambient Air Monitoring
    Plan. This revision specifies the criteria for dust suppression
    if the mini-RAM dust reading shows an excess of three times the
    background reading.

Revision to the Ash Sampling Procedure:

    The ash sampling procedure submitted to you on November 10
    (DJH-21-87) has been revised to reflect the return to the use of
    roll off boxes. The revise plan is provided as Attachment 6.

If you have any questions concerning this information please call
Mr. Carl Friedrich or Major Stoddart at (601) 864-4139. I will be
unavailable until December 8.

                    Very truly yours,

                    Daniel J. Haley
                    Sr. Programs Specialist
                    Hazardous Waste Projects

Attachments:
As Stated

cc: Maj. T. L. Stoddart USAF/AFESC
    J. O. Zane EG&G Idaho (w/o attach)

Attachment 4-A

Constituent	Analytical Methods[a]	Detect. Limits[b](ug/Kg)
Arsenic	__c	__c
Barium	__c	__c
Benzidine ([1,1'-Biphenyl]-4,4' diamine)	SW846-8250	44.000
Benzo[a]anthracene (1,2 Benzanthracene)	SW846-8250	7.800
Benzo[b]fluoranthene (2,3-Benzofluoranthene)	SW846-8250	4.800
	SW846-8310	0.018
Benzo[a]pyrene (3,4-Benzopyrene)	SW846-8100	__d
	SW846-8250	2.500
	SW846-8310	0.013
	-8310	0.023
Bis(2-chloroethoxy)methane (Ethane,[methylenebis (oxy)]bis[2-chloro-])	SW846-8010	__d
Bis(2-chloroisopropyl) ether (Propane, 2,2'-oxybis[2-chloro-])	__e	__d
Cadmium	__c	__c
Chlorinated benzenes, N.O.S.	__e	__d
1,2,4,5-Tetrachlorobenzene	__e	__d
1,2,3,5-Tetrachlorobenzene	__e	__d
Chlorinated phenol, N.O.S.	__e	__d
2.4-Dichlorophenol	SW846-8040	0.390
		0.630
2.6-Dichlorophenol	SW846-8040	__d
	SW846-8250	2.700
2,5-Dichlorophenol	__e	__d
3,4-Dichlorophenol	__e	__d
2,3,4-Trichlorophenol	__e	__d
2,4,5-trichlorophenol	__e	__d
2,4,6-Trichlorophenol	SW846-8040	0.640
	SW846-8250	2.700
2,3,4,5-Tetrachlorophenol	__e	__d
2,3,4,6-Tetrachlorophenol	__e	__d

Chromium	__c	__c
Chrysene (1,2-Benzphenanthrene)	SW846-8100	__d
	SW846-8250	2.500
	SW846-8310	C.150
Coal tars	__e	__d
Creosote (Creosote, wood)	__e	__d
Cresols (Cresylic acid) (Phenol, methyl-)	SW846-8040	__d
Dibenz[a,h]anthracene (1,2,5,6-Dibenzanthracene)	__e	__d
3,3'-Dichlorobenzidine ([1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-)	SW846-8250	16.500
2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters (Acetic acid, 2,4-dichlorophenoxy-, salts and esters)	SW846=8150	1.000
4.6-Dinitro-o-cresol and salts (Phenol, 2,4-dinitro-6-methyl-, and salts)	__e	__d
2,4-Dinitrophenol (Phenol, 2,4-dinitro)	SW846-8040	13.000
	SW846-8250	42.000 (d)
2,4-Dinitrotoluene (Benzene, 1-methyl-2,4-dinitro-)	SW846-8090	.060
	SW846-8250	5.700
2,6-Dinitrotoluene (Benzene, 1-methyl-2-6-dinitro-)	SW846-8090	.060
	SW846-8250	1.600
Fluoranthene (Benzo[j,k]fluorene)	SW846-8100	__d
	SW846-8250	2.200
	SW846-8310	0.210
Hexachlorodibenzo-p-dioxins	SW846-8280	__d
	__e	__d
Hexachlorodibenzofurans	SW846-8280	__d
	__e	__d
Hydroxydimethylarsine oxide (Cacodylic acid)	__e	__d
Indeno (1,2,3-cd) pyrene (1,10-1,2-phenylene) pyrene	SW846-8120	__d
	SW846-8250	3.700
	SW846-8310	0.043

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Lead	__c	__c
Mercury	__c	__c
Nickel	__c	__c
4-Nitrophenol (Phenol, 4-nitro-)	SW846-8040	2.800
		.700
	SW846-8250	2.400
N-Nitrosodimethylamine (Dimethylnitrosamine)	SW846-8250	__d
Pentachlorodibenzo-p-dioxins	SW846-8280	__d
	__e	__d
Pentachlorodibenzofurans	SW846-8280	__d
	__e	__d
Phenol (Benzene, hydroxy)	SW846-8040	0.140
		2.200
	SW846-8250	1.500
Polychlorinated biphenyl, N.O.S.	SW846-8040	__d
		0.065
Selenium	__c	__c
Silver	__c	__c
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	SW846-8280	__d
Dibenzo-p-dioxin, 2,3,7,8-tetrachloro-)	__e	__d
Tetrachlorodibenzo-p-dioxins	SW846-8280	__d
	__e	__d
Tetrachlorodibenzofurans	SW846-8280	__d
	__e	__d
Toxaphene (Camphene, octachloro-)	SW846-8250	__d
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)	SW846-8150	0.100
(Acetic acid, 2,4,5-trichlorophenoxy-)		

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a. Where analytical protocols are specified they are EPA-SW-846

b. Detection levels given are ug/Kg in water per SW-846. Soil values may be higher but must be the lowest possible, utilizing the most sensitive equipment available.

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c. For metal analysis the protocol utilized must produce the lowest detection
limits possible and results should indicate amount present. In addition, EP
Toxicity (6.3 x Drinking water standards) should be reported.

d. No detection limit specified. Detection level must be the lowest possible,
using the most sensitive equipment available.

e. No protocol specified. Protocol used must produce the lowest detection level
possible and be recognized as the CLP or industry standard. Protocols used
must be approved by EG&G Idaho, Chemical Sciences Branch.

MODIFICATION NO. 1

TO

SUBCONTRACT NO. C86-131150

BETWEEN

EG&G IDAHO, INC.

AND

IT CORPORATION

THIS MODIFICATION NO. 1, effective February 9, 1987, is issued to accomplish the following:

1. Increase the Scope of Work; and

2. Add a unit cost for shipping charges and additional rates per analysis in the Pricing Schedule, Appendix B.

The parties hereby mutually agree to the following changes:

ARTICLE 2 - SCOPE OF WORK is modified to include:

Additional analytical parameters will be performed of samples by the methods identified below. Requirements, Quality Assurance/Quality Control Plan, and Deliverables as defined in the Scope of Work will apply.

Samples	Parameter	Method
Ash Drag	Cyanide	SW 846-9010
	Sulfide	SW 846-9030
	Corrosivity	EP Toxicity Extraction
	Total Cyanide	EP Toxicity Extraction
Untreated Soil	Total Chlorinated Dibenzodioxins and Dibenzofurans 2, 3, 7, 8 - TCDD with Data Package	Low Res MS
Hi Vol Filters	2,4-D & 2,4,5-T	SW 846-8150
POTW Discharge	BOD	Standard Methods
	COD	Standard Methods

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Attachment 4-B

lyte	Matrix	Method	Description
:, ,7,8-TCDD	Water	ITAS S.O.P.	USEPA CLP/SW-846 8280 Modified for HRGC/HRMS (1,2)
	Soil	ITAS S.O.P.	USEPA CLP/SW-846 8280 Modified for HRGC/HRMS (1,2)
	Stack Gas	ITAS S.O.P.	USEPA CLP/SW-846 8280 Modified for HRGC/HRMS (1,2)
'CDD/TCDF(total)	Water	ITAS S.O.P.	USEPA CLP/SW-846 8280 Modified for HRGC/HRMS (1,2)
	Soil	ITAS S.O.P.	USEPA CLP/SW-846 8280 Modified for HRGC/HRMS (1,2)
	Stack Gas	ITAS S.O.P.	USEPA CLP(SW-846 8280) Modified for HRGC/HRMS (1,2)
rganics (BN/AE)	Water	USEPA CLP SOW(3)	L/L Extraction, GC/MS Analysis
	Soil	USEPA CLP SOW(3)	Sonication Ext., GC/MS Analysis
	Stack Gas	SW-846 3510,3540 EPA CLP SOW(2,3)	L/L & Soxhlet Ext., Combine Extracts & Analyze per CLP
oxaphene/PCB's	Water	USEPA CLP SOW(3)	L/L Extraction, GC/EC Analysis
	Soil	USEPA CLP SOW(3)	Sonication Ext., GC/EC Analysis
	Stack Gas	SW-846 3510,3540 EPA CLP SOW(2,3)	L/L & Soxhlet Ext., Combine Extracts & Analyze per CLP
lerbicides	Water	SW-846 8150(2)	Extraction, Methylation, GC/EC
	Soil	SW-846 8150(2)	Extraction, Methylation, GC/EC
	Stack Gas	SW-846 3510,3540 8150(2)	L/L & Soxhlet Ext., Combine & Methylate Extracts, GC/EC
'AH's	Water	SW-846 8310(2)	L/L Extraction, HPLC Analysis
	Soil	SW-846 3540,3550 8310(2)	Soxhlet or Sonification Ext. HPLC Analysis
	Stack Gas	SW-846 3510,3540 8310(2)	L/L & Soxhlet Ext., Combine Extracts & Analyze by HPLC
etals	Water	USEPA CLP SOW(4)	Digestion, AA or GFAA Analysis
	Soil	USEPA CLP SOW(4)	Digestion, AA or GFAA Analysis
_s	VOST	SW-846 3720	Thermal Desorption, GC/MS
	MM5	SW-846 3510,3540 EPA CLP SOW(2,3)	L/L & Soxhlet Ext., Combine Extracts & Analyze per CLP

List of Standard Operating Procedures

Hazard Laboratory - Directors Drive - Dioxin Analysis

EM.1 Extraction Method for Soils And Sediment
EM.2 Extraction Method for Soils And Sediment (Soxhlet Extraction)
EM.4 Extraction Method for Water
EM.8 Extraction Method for Organic Liquids
EM.9 Extraction Method for Industrial Hygiene Samples(to include Ambient Air, XAD, Florisil, Silica Gel, and Resin Traps)
CM.1 One Column Cleanup
CM.2 Silica Gel/Alumina Column Cleanup
CM.3 Caustic and Acid Cleanup
CM.3 Activated Carbon Cleanup
IP.4 2,3,7,8-TCDD Analysis Procedures by Multiple Ion Detection (MID) High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS)
IP.5 Total PCDD and PCDF Congener (C14-C18) Analysis Procedures by Multiple Ion Detection (MID) High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS)
QC.1 Standard Verification and Working Stock Solutions
QC.2 Performance Checks
QC.3 Blanks
QC.4 Duplicate Analysis
QC.5 Spike Analysis
QC.6 Blind QC Samples
QC.7 Confirmatory Partial Scan Analysis
QC.8 Sample Rerun Requirements
    Corrective Action
    Sample Tracking
DM.2 Analysis Forms
DM.3 Data Reports
DM.4 Data Review

IT Analytical Services - Middlebrook Pike - Organic and Inorganic Analysis

CD01 (CD841010R0) Receipt and Logging in of EPA Contract Laboratory Program Samples
QC02 (QA841214R01) Work Assignments, Analysis Tracking, and Sample Chain of Custody for the EPA Contract Laboratory Program
QC05 (QA841113R0) Sample Storage for EPA Contract Laboratory Program
QC07 (QA851023R) Quality Control Practices, Data Validation, and Acceptability Criteria for Samples Analyzed by USEPA Contract Laboratory Program Protocol
QC04 (QA841213R0) Document Numbering and Inventory Procedure for Use in EPA Contract Laboratory Program
IM01 (IS851022R0) Samples to be Analyzed for Inorganic Parameters Following USEPA Contract Laboratory Protocol
GC09 (GC841213R2) GC Sample Analysis and Tracking
MS08 (M841218R0) GC/MS Sample Analysis and Tracking
MS05 (MV860416R0) Analysis of VOST Tubes for Volatile POHC's
LC03 (HP850904R0) Determination of Polynuclear Aromatic Hydrocarbons on XAD-2 Resin Air Filters by HPLC

References

SEPA Contract Laborat_ / Program, Statement of Work for Dioxin Analysis. _ber 9, 1983, IFB WA8. \002.

2) "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", USEPA Office of Solid Waste and Emergency Response, SW-846, July 1982, 2nd Edition.

3) USEPA Contract Laboratory Program, Statement of Work for Organic Analysis, 7/85 Revision.

4) USEPA Contract Laboratory Program, Statement of Work for Inorganic Analysis, SOW No. 785, July 1985.

Attachment 6

ASH SAMPLING PROCEDURE
CODE ORANGE PROJECT
GULFPORT, MS.
Revised November 20, 1987

I. General: Each batch of ash must be sampled and held pending
satisfactory analytical results, before the ash can be removed
from the roll off bins and returned to the excavated area for
back-filling. Approximately 15 to 20 cubic yards of ash will
be placed into each roll off bin. In a normal days operation
it is projected that 5 or 6 roll off bins will be filled with
ash each day. A composite sample will be obtained from each
roll off bin. To reduce analytical costs, a portion of each
roll off bin composite sample will be composited to form a
daily composite sample. The daily composite and the samples
from each of the bays will all be sent to the laboratory, but
the daily composite will be analyzed first; if it is "clean"
the individual bay samples will not be analyzed. If the daily
composite shows a concentration in excess of 1.0 ppb of
2,3,7,8 TCDD or total tetra chlorinated dibenzo dioxins or
total chlorinated dibenzo furans, then the samples from the
individual roll off bins will be analyzed to determine where
the contaminated ash is stored. If a sample is rejected on
high contaminant level, the entire contents of the roll off
bin from which the sample was taken will be reprocessed in the
incinerator.

II. Required Supplies and Equipment:

1. 8ounce I-Chem glass sample jar with teflon-coated lid and
numbered label.
2. 32ounce I-Chem glass sample jar with teflon-coated lid and
label.

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3. Aluminum pan.

4. 8 mesh screen.

5. Aluminum or plastic scoop.

6. Soil Sample Data Sheet

7. Quart-size zip-lock plastic bag.

8. Plastic trash bag.

III Sampling Procedures:

1. Use a clean scoop for the sampling of each roll off bin.

2. As a minimum, wear the disposable rubber boots and gloves that are required for Level "C" protection.

3. Scoop up four scoopfuls of ash from each side of the ash in the bay. Dump each scoopful through the screen in the aluminum pan as you scoop it up.

   The location of the scoops should be equally spaced in order to obtain a more representative sample. Due to the mixing of the soil in the kiln and during ash transport to the roll off bin, the process soil will be extremely well mixed thus providing a homogeneous ash product.

4. Mix the sample thoroughly in the pan and pour from the pan into the small sample jar. Dump one scoopful of the roll off bin sample into the large composite sample jar.

5. Clean any excess ash off of the sample jars and put the lids tightly on the jars.

6. Log all required information on the Field Sample Data Sheet.

7. When samples have been collected from all roll off bins filled during the day's operation, the composite sample from the large sample jar is dumped out into a clean aluminum pan and mixed thoroughly with a clean scoop. An 8 ounce or larger sample jar is to be filled with the daily composited mixture. It must be clearly marked " Ash Composite" on the Soil Sample Data Sheet, and the roll off bins from which the composite sample was taken noted in the remarks section so that there is no mistake as to which roll off bins the composite was made from.

8. Put each filled small jar in a zip-lock bag and carry it to the sample trailer.

9. Collect the large sample jar and all used scoops and pans in the trash bag for disposal.

IV Preparation For Shipment:

Follow Section IV of the Soil Sampling Procedure, except that all ash samples must be noted as being for 3 day turnaround by the laboratory, and they must go out in the very next shipment of samples. Mark the Chain-of-Custody form accordingly. Identify the Ash Composite sample as such on the Chain-of-Custody form and note the individual sample numbers that make up the composite.